FLIGHT
and The AIRCRAFT ENGINEER

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The Outlook

Liddell Hart on A.A. Defence

FOR years past *Flight* has protested against the practice of divided command in defence matters. Recently the authorities made an important move towards unity by giving the Admiralty full control over the Fleet Air Arm, but there remains the vital question of unity in the air defence of the country. It is gratifying to find strong support given to the principle of unity in the book, *The Defence of Britain*, by Capt. Liddell Hart, which has just been published by Faber and Faber, Ltd.

Capt. Liddell Hart is an Army corresponent and a great authority on Army matters. He looks at defence problems through Army eyes, not with the eyes of an Air Force authority. Consequently, when he sees something wrong, it is not to be expected that he will find the same best solution as must appear obvious to *Flight*. In the present case, the support which he gives to our case is in seeing and explaining what is very wrong with the present system and in advocating unity of command, not in the specific remedy which he advocates.

Anti-aircraft defence has been the Cinderella of the War Office ever since the ground side of it was handed over to the Territorial Army. In his new book Capt. Liddell Hart traces the expansion of the A.A. side of the Territorial Army and tells of the appalling mistakes made by the War Office in dealing with the problem. It is a terrifying story.

The General Staff, it appears, was chiefly concerned to get ready an expeditionary force, and money spent on A.A. defence was looked on as money taken away from "the Army." That attitude seems to us reasonable enough, because air defence ought not, in our opinion, ever to have been regarded as an Army matter. It was a natural result of building on an illogical foundation. When Mr. Hore-Belisha decided to give priority to the production of anti-aircraft weapons, the first of these were given to the regulars who would go overseas with the expeditionary force, not to the Territorials who had to defend the homeland. The A.A. units had to deal with eight different departments of the Army in getting anything done. The training and administration of the A.A. divisions was in the hands of the Army Commands in which their drill halls were situated, while for operations they came under the Fighter Command of the Air Force. In fact, not only had the A.A. units to take orders from two Departments of State, but even inside the Army they were subject to divided responsibility and control. It makes a sorry story of muddle.

At length a real improvement was made by the appointment of a Deputy Chief of the Imperial General Staff (Anti-Aircraft Defence) at the War Office, so that the whole A.A. business is now concentrated in the hands of one officer, who has sufficient authority to get things done; but still the units have to change from War Office control to Air Ministry control so soon as operations begin.

Suggested Remedies

CAPT. LIDDELL HART'S suggestions include the following. On page 172 he proposes that the barrage balloons should be transferred from the Auxiliary Air Force to the Territorial Army. On page 182 he suggests, rather tentatively, that we might constitute the defences of the country, civil and military, as a fourth Service. Those two suggestions show his appreciation of the evils of divided control and his desire for unification. He is prepared to make large and complicated reforms in order to achieve his object.

We agree entirely with the principle underlying his ideas, but we differ from him in the remedy he puts forward. We do not need a fourth Service; the obviously rational thing to do is to place the Air Ministry in full control of the ground elements of air defence. It is inevitable that in case of war all the operations must be under the Air Officer Commanding-in-Chief the Fighter

THE OUTLOOK (CONTINUED)

THIS WEEK'S GREAT ANNIVERSARY: On Tuesday a banquet was held in London to commemorate the 30th anniversary of the first flight across the English Channel, made by Louis Blériot in 1909. Blériot—who died three years ago—is seen in this picture, and the historic arrival at Dover is also shown.

Command. The fighter aeroplanes are the main striking part of the force, and the guns, lights, etc., are ancillary to them. All the elements need to work in the closest collaboration, and the gunners and searchlight sappers ought to be raised, trained, organised, paid and promoted by the Ministry which will control them in war. The balloon squadrons are in the right position; it is the others which are wrong. Capt. Liddell Hart has shown that the War Office does not whole-heartedly regard the A.A. units as part of the Army, and most certainly they are not a part of Army defence. They are an indispensable part of air defence, and ought to be administered by the Air Ministry.

A Blériot Anniversary

ONLY a few weeks ago the twentieth anniversary of the crossing of the Atlantic by Alcock and Whitten Brown was celebrated. This week we have celebrated the thirtieth anniversary of the first crossing of the Channel by the late M. Blériot. It is not the first celebration of that landmark in aeronautical history, but at the last one the gallant pilot was present in person, and now he has joined the great majority.

Once aero engines became reasonably reliable, crossing the Channel by air was bound to become a commonplace of travel and also of war. Blériot's effort was a demonstration of future possibilities, and some of those possibilities have proved distinctly unpleasant for British citizens. They are, however, not all unpleasant. From the military point of view the greatest result of flying for Great Britain is that it has made invasion by an Army carried on sea transports a practical impossibility. Such invasions could only succeed if the landing were a surprise, and with air reconnaissance such surprise could not be brought about. Moreover, a landing of troops in face of an active hostile air force is now recognised to be quite impracticable.

And now, thirty years later, British bombers take the Channel in their stride on practice flights to Marseilles and back without landing, using merely as a check on navigation the strip of sea which caused Blériot so much anxiety until a shower came to his rescue and "water-cooled" his overheating air-cooled engine.

Proficiency Near the Ground

"WHAT I want to see is proficiency near the ground, not stunting," was the motif of the speech made by Col. Smith-Barry at the Gosport reunion dinner at Brooklands last Saturday, reported on p. 85. One may recall that "S.-B." invented the sideslip and the cross-wind landing, manœuvres which enabled the biplanes of the R.F.C. to be regularly put down safely in quite small fields.

It is to be feared that making a forced landing is becoming something of a lost art to-day. This is due partly to the reliability of the modern aero engine (there are Short-Service officers who have served their time in the R.A.F. without ever having had to make such a landing) but also to the fact that the modern high-performance aeroplane cannot very easily be manœuvred to a spot landing without the help of the engine—or so it is generally held.

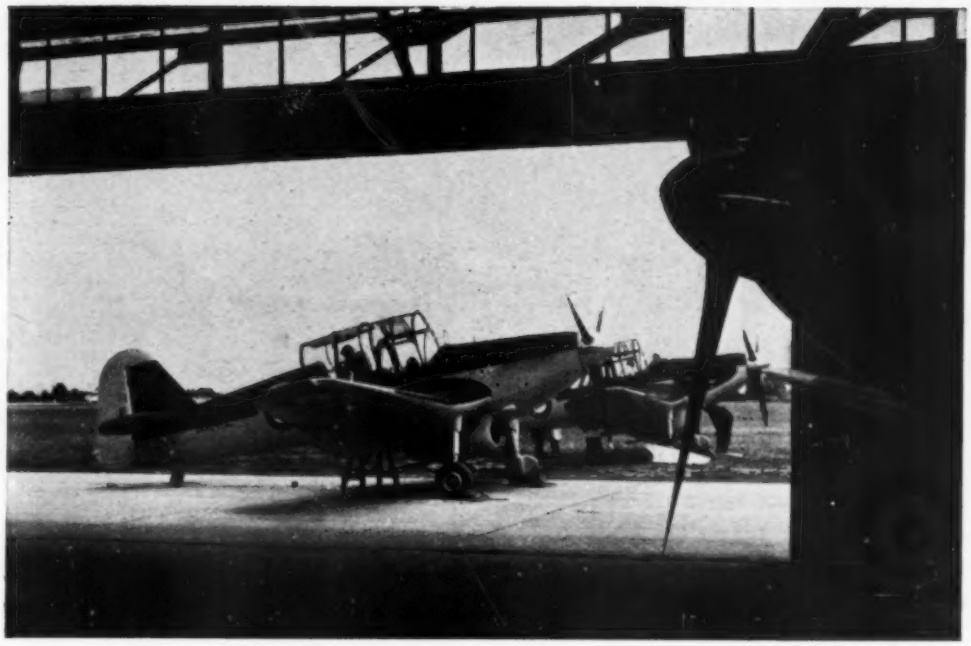
But let us not forget that the same thing was thought of the aeroplanes of the war period. In fact, when the French first saw sideslip landings made with Avro 504s they thought that the machine had been specially designed for this purpose. May it not be that a modern "S.-B." will arise and show us that even our high-performance monoplanes can be put down accurately and safely without rumbling? The trailing edge flap is meant partly to relieve the pilot of the need for the sideslip, and, in fact, low-wing monoplanes with flaps often show peculiar and even dangerous behaviour if a low-speed sideslip is attempted. But it does seem reasonable that a routine method, using, perhaps, a combination of gliding turns and flap application, may be developed which will do for the modern aeroplane what Col. Smith-Barry's discovery did for the machines of the 1917 vintage.

Already the sequence of advanced instruction is being altered to suit the characteristics of present-day machines, and the more experienced pilots have themselves developed various examples of no-engine approach technique. What is required is a more standardised and scientifically planned routine which will be as certain as the old gliding-turn and final sideslip system and allow, similarly, for minor errors of judgment.

Good Cause

FOR many years the Service has had its Benevolent Fund, augmented from the proceeds of such events as the Hendon Display and Empire Air Days. Civil aviation also has a fund, administered by the Guild of Air Pilots and Navigators. This latter fund is comparable in purpose but, lacking a big, ready-organised field for contributions, falls short in size.

A strenuous effort is being made to put matters right. The cause of the commercial pilot (no matter what his branch) and his dependants is a deserving one, and all those who turn up at the Redhill Display next Saturday will be assisting it. Details appear on page 94.



"Flight" photograph.

TRAINER DE LUXE

The Miles Master I Described : High Performance with Comparatively Low Power : All-wooden Construction

FIRST deliveries are now being made to the R.A.F. of the Miles Master I two-seater advanced training monoplanes built by Phillips and Powis Aircraft, Ltd., at their Reading works. Fitted with the specially developed Rolls-Royce Kestrel XXX "training" engine, the Master has a top speed of 264 m.p.h., and will enable pupils to "get on a few 'G,'" and generally to accustom themselves to the handling characteristics of contemporary monoplane fighting aircraft, apart from providing for front-gun practice and other branches of instructional flying.

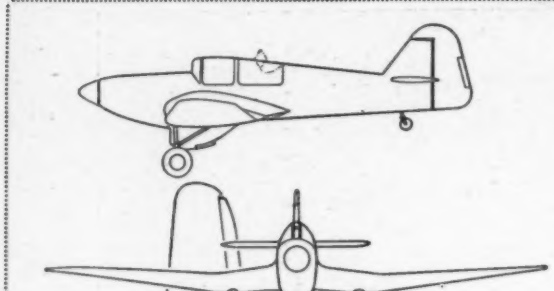
The Master I may be considered as a development of the original Miles Kestrel Trainer, which was capable of 295 m.p.h. or more with a Rolls-Royce Kestrel XVI engine of 745 maximum h.p. Technically, the machine is interesting more for its aerodynamic features than for its structure, which is, in fact, quite orthodox.

The oval-section plywood-covered fuselage is of fine aerodynamic form and of semi-monocoque construction with a large cut-out for the cockpits. The tail unit is of conventional cantilever design, the tailplane being mounted on top of the rear portion of the fuselage, in which position it has a wide attachment base and facilitates recovery from a spin.

Between the tandem cockpits (the pupil occupies the front seat) is a sturdy metal former which, while not projecting beyond the fuselage, offers protection for the crew in the event of a nose-over.

The plywood-covered wing is of N.A.C.A. 230 section and is very deep at the root, though the top spar boom is continued across the fuselage without interfering with the pilot's use of the rudder bar. The two spars are of normal box construction, but are specially shaped to give the "inverted gull" centre section which is characteristic of

There is no doubt that, in the Master, Service trainees will have "a real aeroplane." The top speed of over 260 m.p.h. can be credited on examining this view.



MILES MASTER I

Rolls Royce Kestrel XXX Engine

DIMENSIONS AND AREAS

Length	30ft. 8in.
Minimum height (tail down)	10ft.
Span	39ft.
Track	12ft. 3½in.
Airscrew diameter	10ft.
Wing area	217 sq. ft.
Aileron area	16.72 sq. ft.

WEIGHTS

Tare weight	4,160 lb.
Fuel (70 gal.)	525 lb.
Oil (5 gal.)	45 lb.
Pilot, pupil and parachutes	400 lb.
Equipment	145 lb.
Max. permissible weight	5,500 lb.

PERFORMANCE

Top speed at sea level	209 m.p.h.
Top speed at 10,000ft.	244 m.p.h.
Top speed at 15,000ft.	264 m.p.h.
Cruising speed (two-thirds power at 15,000ft.)	230 m.p.h.
Range at 216 m.p.h. (allowing 20 gal. of petrol for ground running, climb and descent)	440 miles
Climb to 15,000ft.	10 min.
Service ceiling	28,000ft.
Take-off run (still air)	295 yd.
Landing run (still air, using flaps and brakes)	320 yd.
Landing speed	67 m.p.h.

the Master. This feature, of course, makes for higher production costs, but it is felt that it is justified on the grounds of performance. The depth of the centre section permits stowage of the fuel tanks and the undercarriage in its retracted position The centre section houses a free-firing machine gun and parachute flares are carried in the outer panels.

Hydraulically operated split trailing-edge flaps extend under the fuselage. These may be depressed to an angle of about 25 deg. for take-off and 90 deg. for landing. Their position is recorded by an electrical indicator on the instrument panel. All electrical leads are housed in ducts.

High-tensile steel, backed up with forgings and magnesium-alloy castings, is used for the engine mounting attachment plates. The Rolls-Royce Kestrel XXX is mounted with Ferodo packings under the bearer feet, and the steel tubular mounting is designed to facilitate engine removal. The complete installation (power unit, vacuum pump and relief valve, hydraulic pump and constant-speed unit) may be taken out of the airframe by removing four main bolts and disconnecting the various leads through the bulkhead.

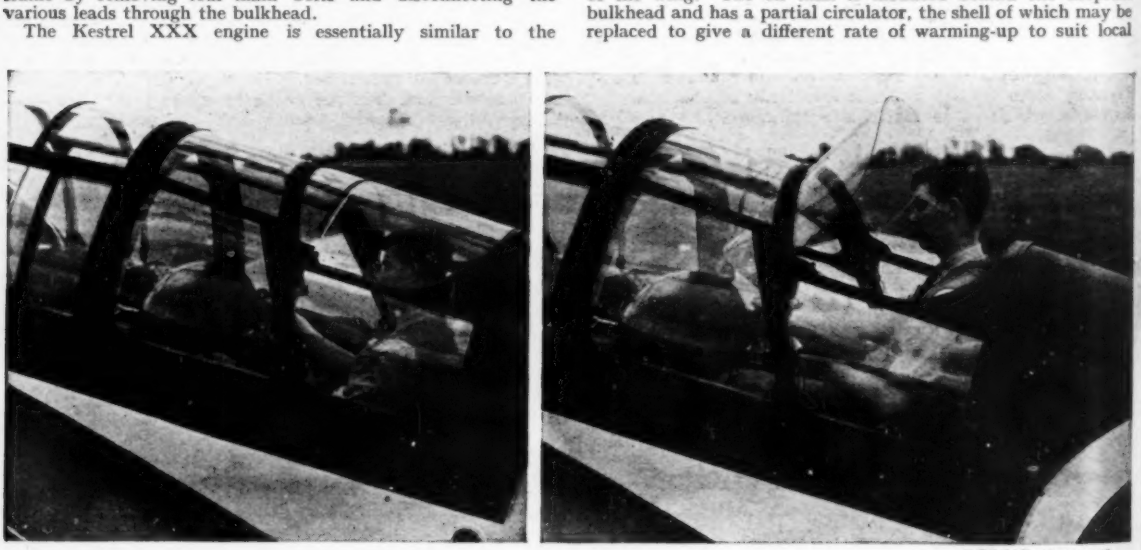
The Kestrel XXX engine is essentially similar to the Kestrel V, but in comparison is derated for climbing and level flight to provide the longer overhaul life required by a training aircraft, the rated boost being reduced to +½lb./sq. in. A high take-off power is, however, retained. The actual figures are: rated power, 550 h.p. at 2,400 r.p.m. at 11,750ft.; maximum power, 600 h.p. at 2,750 r.p.m. at 14,500ft.; take-off power, 720 h.p. at +5lb. boost at 2,750 r.p.m. An ejector-type exhaust system is used.

Hand-starting gear is fitted as standard, and auxiliary drives are provided for a vacuum pump for driving the gyroscopic instruments; a constant-speed unit driven from a dual-drive unit at the front of the reduction gear casing; a Lockheed hydraulic pump for undercarriage and flaps; a high-pressure air compressor; and a 500-watt Rotax electric generator.

The airscrew shaft of the Kestrel XXX will accommodate either a Rotol or De Havilland constant-speed airscrew. For the Rotol, which is standardised on the Master, the oil supply passes through an external muff type of feed located in the housing at the front of the reduction gear casing.

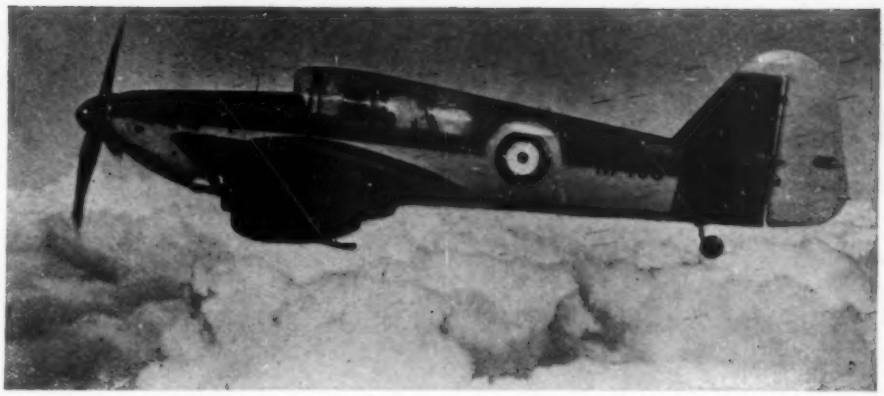
Under the fuselage, between the spars, is a low-drag cooling duct for the water and oil systems. This has a variable outlet controlled from the front cockpit.

The main fuel tanks—which, as already stated, are carried in the wing roots—are two in number and hold 36 gallons each. They are readily removable through doors in the lower surfaces of the wing. The oil tank is mounted behind the fireproof bulkhead and has a partial circulator, the shell of which may be replaced to give a different rate of warming-up to suit local



"Flight" photograph.

Showing how, for landing, the instructor can raise himself to obtain a good view. The raising of the windscreen is automatic.



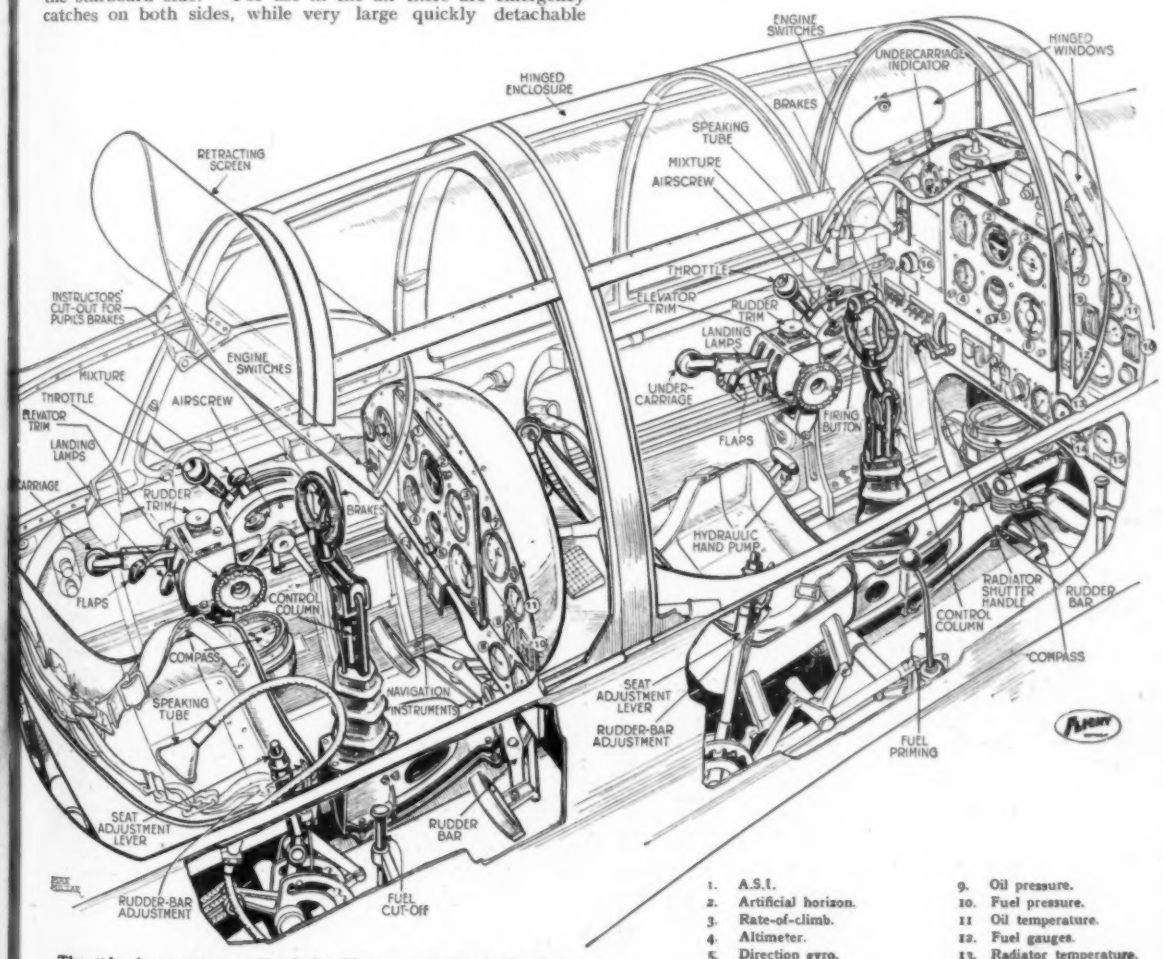
Mr. H. W. C. Skinner, chief test pilot, does a "straight and level" above the clouds on a production Master.

conditions. The water header tank is mounted at the front of the engine above the reduction gear housing.

The retractable undercarriage is of particular interest in that the wheels twist through 90 deg. during retraction into the centre section. There are two independent units which are operated by the Lockheed hydraulic circuit, though emergency pipe lines and a hand pump are fitted in case of failure of the main pump. A position indicator is interconnected with the ignition switch and the throttle control. Notwithstanding the fact that the electrical indicator is fitted with duplicate bulbs a mechanical indicator is also fitted. The brakes are hydraulically operated, and the wheels and tyres can be Palmers or Dunlops. A cut-out is provided in the instructor's cockpit to render the pupil's brake controls inoperative.

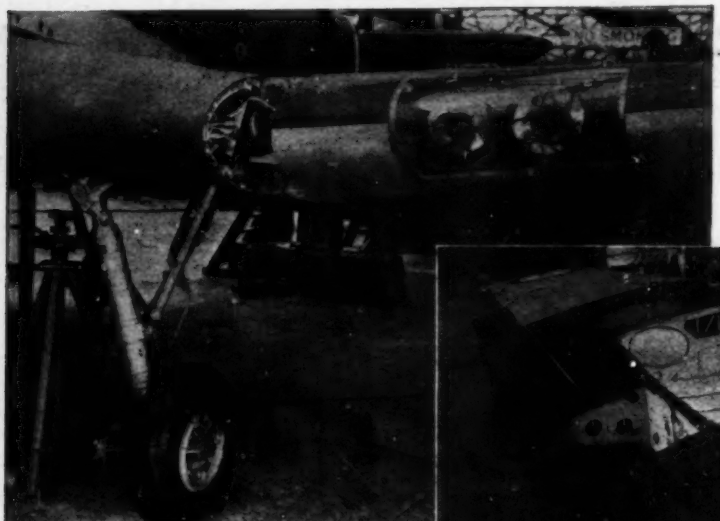
As the Master is an advanced Service trainer, much of the interest centres on the cockpits which are both commodious and comfortable. The front windows of the enclosure slide upwards on channels round the port side, there being a fixed hinge on the starboard side. For use in the air there are emergency catches on both sides, while very large quickly detachable panels are also fitted to permit rapid exit from either cockpit on either side should the machine nose-over on landing. The front windscreen is of moulded Perspex, and is fitted with a Triplex panel in the region of the reflector gun sight to give an optically perfect view of the target. For bad-weather flying two small panels in the screen may be opened. The remarks concerning the emergency exits and the opening of the front windows apply equally to the rear windows. Provision is made for sunblinds under the top portion of the cabin roof.

Of special interest are the arrangements made to ensure that the landing view from the rear seat is comparable with that



The "business quarters" of the Master, our latest Service trainer. A key to the instruments, which are numbered in the drawing, appears on the right.

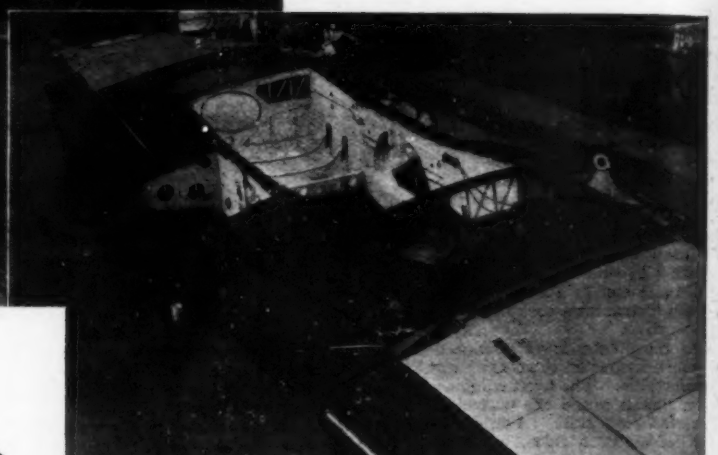
1. A.S.I.
2. Artificial horizon.
3. Rate-of-climb.
4. Altimeter.
5. Direction gyro.
6. Turn indicator.
7. R.P.M.
8. Boost
9. Oil pressure.
10. Fuel pressure.
11. Oil temperature.
12. Fuel gauges.
13. Radiator temperature.
14. Brake pressure.
15. Hydraulic pressure.
16. Landing-light switch.



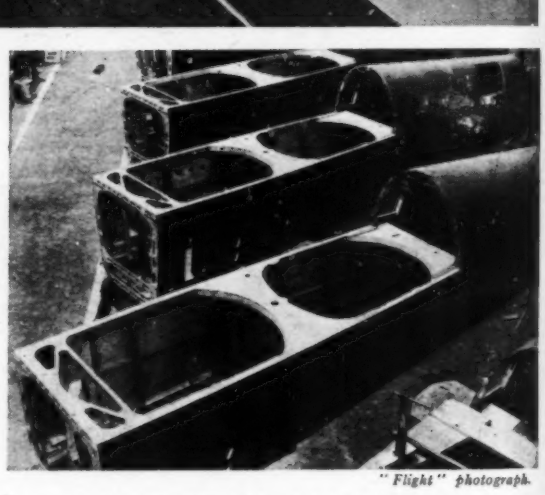
(Left) Undercarriage and landing light installation. The wheels turn 90° during retraction.

(Below) The complete wing of a Master showing the formation of the centre gulled portion.

"Flight" photographs.



A typical control run on the Master, showing the application of the neat rubber-tyred ball races.



"Flight" photograph.

Semi-monocoque fuselages in train for Masters.

from the front. A vertical adjustment of the seat of 12in. is allowed instead of the normal 4in., bringing the occupant's head outside the normal fairing line of the cabin roof and giving him a good view over the leading edge. Whilst in this position he is protected by a windscreen which is automatically raised out of the cabin. The adjustment of the rudder bar may be made simultaneously with the change in position of the seats.

The great majority of the instruments and equipment in the cockpits are visible in the drawing on p. 79, though special reference may be made to the Miles control unit, which incorporates Hobson patents and embodies a throttle, mixture and pitch control, levers for the undercarriage flaps and landing lights, elevator trim wheel and indicator, boost cut-out lever and rudder trim control wheel and indicator. Another feature of special interest is the Graviner fire-extinguisher installation. The extinguisher itself is mounted behind the rear seat, a tube leading forward into the engine bay. This tube is detachable in the front cockpit, and may be used to play on any fire which might occur in that region.

On the floor are the emergency hydraulic valve for working the undercarriage and the emergency hydraulic hand pump. The rest of the hydraulic gear is situated beneath the floor, and is accessible through a removable panel on the underside of the fuselage.

Particularly commendable is the grouping in a single unit in each cockpit of an adjustable rudder bar and control column and the gun-firing gear. Push-pull tubes stabilised by ball-races covered with rubber tyres are used throughout the entire control system. Damped trimming tabs operated by irreversible mechanisms fitted as close to the tabs as possible are fitted to the elevator and rudder. Each has its own indicating system and may be operated from either cockpit.

A list of makers of Miles Master equipment appears on p. 100.

LORD WAKEFIELD AS A MODEL HOST

THAT model aeroplane making and flying is a great force in promoting international understanding and good will was the main theme of all the speakers at the dinner given by Lord Wakefield at Grosvenor House, London, last Monday, to the winners and competing teams for the King Peter Cup (an international model glider contest for a cup presented by the young ruler of Yugoslavia), and to the British team which is shortly leaving for America to take part in the competition for the Wakefield Cup there. The latter is held annually.

Lord Wakefield presided at the dinner, and speeches were made by him, by Lt.-Col. Moore-Brabazon, by His Excellency, M. Ivan Soubbotitch, Yugoslav Minister, by Mr. Copland, world record holder and member of the British Wakefield team, and by Dr. Thurston, president of the Society of Model Aeronautical Engineers. An account of the proceedings will be given in our next "Models" page.

PRESENTING the PROTOTYPES

Mid-show Demonstrations at Brussels : No Real Prototypes, but Some Good Flying

IT could hardly be said that the machines at the special prototype demonstrations on July 18 at Haren—or Evere, as you will—were very new or very representative, and one or two of the more interesting military types which were expected failed to put in an appearance. The day was a predominantly German one, and the only British representatives were three Percival types, a Q.6, a Vega Gull and a Mew Gull which had been specially flown over from Luton that morning.

The three outstanding demonstrations of the day were by three German pilots. The first, and one of the earlier morning shows, was that of a Klemm 35; the second by Flugkapitan Hanna Reitsch in her special Habicht sailplane; and the third of a Junkers Ju.86. The Klemm pilot put up an astoundingly good (if slightly dangerous, according to our sober standards) display of aerobatics, starting at about 800ft. and concluding with flick rolls practically at ground level. His execution was masterly, and, more interesting still, he showed that a low-wing monoplane can be designed with a really useful, though flat, sideslip. The 35, then and later on, was brought in flying practically sideways with no sign of excess speed.

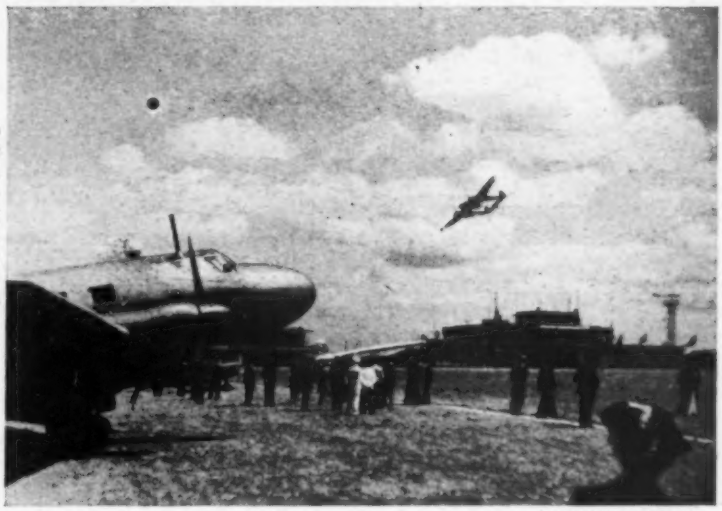
Hanna Reitsch was towed up to about 3,000ft. by an F.W. Stieglitz and managed to cram every possible evolution into her descent, including very flick rolls and a couple of complete bunts, or inverted loops. Just when we thought it was all over, she dived to ground level and looped back to ground level, afterwards making, with what was left of the sailplane's speed, a short circuit and a cross-wind landing along the spectatorial front. Her *Luftwaffe* rank is more than well merited.

There is something magnificently impressive about even the most ordinary of minor aerobatics by a really large machine, and the effect in the case of the Ju.86 was enhanced by the particular and unmistakable drone of a couple of Jumo diesels. Both stalled turns and loops are long drawn out, and, consequently, majestic procedures. Though the 86 was lightly loaded, its one-engine performance (both port and starboard motors were cut in turn) was worthy. There was no doubt about it, either, because by feathering each of the airscrews the engines could be made to stop entirely and the machine was turned against what drag there was. After the second demonstration the starboard engine was left dead, and the pilot made a one-engine approach and landing—after which his assistant applied a starting cartridge to it.

Dive Bombers

Of purely military types the most interesting were the Fokker G.1 and the Junkers 87 dive-bomber. Unfortunately, the pilot of the Fokker (two Bristol Mercury) chose to carry out his dive demonstrations between what appeared to be 15,000ft. and about 8,000ft., but he certainly showed that the machine was manœuvrable, with all the usual aerobatics, including aileron turns on the dive and spins, and later on he showed the machine's slow and flick rolls at a rather more "viewable" altitude. The G.1, it may be remembered, is the development of the original *Le Faucheur* which was first exhibited at Paris four years ago. It is rumoured that, following the annexation of Czechoslovakia, quite a few machines of this type are in use in the *Luftwaffe*.

One felt that it was a pity that a Blackburn Skua was not in the sky to set itself off against the Junkers dive-bomber. From what we have seen of the Skua it would, on a considerably lower power, make a more than interesting comparison. The 87 has four slats just aft of the leading edge to limit flying speed, and the pilot's first demonstration followed a somewhat prolonged climb to about 10,000 feet, whence he dived at an angle of about 80 deg. Its speed during the pull out was apparently a good deal greater than that to which the flaps limit the Skua. The Junkers appeared, too, to "hunt" a little during the dive. Afterwards the pilot carried out some very nice inverted flying and some extremely slow rolls.



"Flight" photograph.

The Fokker G.1 multi-purpose monoplane makes its final fly-past at Haren, with the terminal building (and F.W. Condor) in the distance and the nose of a Junkers Ju. 86 in the foreground.

Other military types shown off were the Hanriot twin-engined trainer, which was rolled and looped, including in its repertoire a half roll over and back again, and the Koolhoven F.K.52 two-seater fighter, which resembles in a general way the Gloster Gladiator and has a somewhat similar performance. Owing to an error in the flagging off arrangements, Capt. Percival was in the sky with the Mew Gull at the same time as the F.K.52, and everyone wondered whether the two pilots had seen one another until it became obvious as they started a not unequal form of dog-fight. The Mew Gull certainly gave a good account of itself and showed what can be done with a mere 200 h.p.

The Civil Types

Later in the day the machine was unfortunately broken by a Belgian military pilot who, after showing his very real aerobatic flying ability with the machine, and making an accurate approach, checked it some 5ft. too high, dropped a wing, broke one undercarriage leg, and made a complete semi-circle in a cloud of brown dust—luckily without hurting himself much.

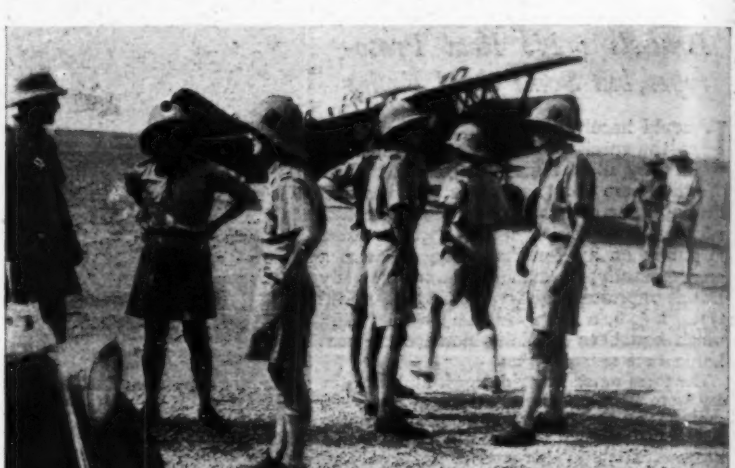
We did not see the Vega Gull demonstrated, but the Q.6 was flown at the same time as the somewhat faster Siebel twin. This is an all-metal type with aerobatic capabilities. Unfortunately, no example of the little Gotha twin was out at Haren. It seems to us that there should be a market for a small twin-engined two-seater of this kind. Later in the afternoon the F.W. Condor and the big Junkers Ju.90 gave passenger flights to various interested parties. The latter was fitted with B.M.W. radials.

Among the new light aeroplanes was an Arado 79, a little all-metal cabin two-seater with a striking aerobatic performance, as well as the ugly but efficient Siebel Hummel which recently broke class records. Apparently the Arado, which, rather unnecessarily, has a retractable undercarriage, would cost about £1,500 over here; otherwise it might find a small market. Apart from the Percivals the only other light aeroplane to be demonstrated was the Belgian Tipsy two-seater in its cabin form.

Altogether it was rather remarkable that there were no particular unrehearsed excitements, since the demonstrations, both official and unofficial, were being carried out at Brussels commercial aerodrome, with airline machines coming in and going out. We came over for a very flying visit in a Sabena Douglas D.C.3 and departed on the following day in one of their Savoia Marchettis—a mere one and a half hours in each direction, and a striking contrast in commercial advantage to the military interest which pervaded both the show and the displays.

SERVICE AVIATION

Royal Air Force and Official Announcements : Fleet Air Arm News : Military Aviation Abroad



VISITING OUT EAST : Thirty R.A.F. officers, led by A.V.-M. G.R.M. Reid, recently flew over from Aden to Djibouti, the port of French Somaliland, to watch the July 14 parade of the French Garrison. The rather antique aircraft in the background are Potez cabin machines.

Higher Appointment

THE Air Ministry announces the appointment of Air Vice-Marshal Richard Ernest Saul, D.F.C., to assume command of the newly formed No. 13 Group, with effect from July 24, 1939.

Air Vice-Marshal Saul, who was born in 1891, served for two years in the Royal Army Service Corps prior to his transfer to the Royal Flying Corps as a Flying Officer in August, 1916. During the Great War he served in France, and was put in command of No. 81 Wing in November, 1918. In January, 1919, he was appointed to command No. 7 Squadron, being awarded the D.F.C. during that month. He was appointed Chevalier of the Belgian Order of the Crown, and received the Belgian Croix de Guerre avec Palme in July, 1919. In August, 1919, he was granted a permanent commission in the Royal Air Force with the rank of Squadron Leader.

During September, 1919, he was appointed to command No. 12 Squadron, with the Army of the Rhine, and in November, 1921, was employed on Air Staff duties at Headquarters, Iraq. He held the command of No. 2 Squadron from April, 1925, to January, 1927, when he attended a two years' course at the Staff College, Camberley. In 1929 he was posted to Headquarters, No. 22 Group, for Air Staff duties. In 1930 he was appointed to the command of the School of Army Co-operation and, from September, 1933, commanded successively No. 203 Squadron in Iraq and Aden, and Royal Air Force Station, Calshot. Since June, 1937, he had held the appointment of Senior Air Staff Officer at H.Q., No. 11 Group.

More Bombers Over France

FOLLOWING the first R.A.F. flight over France by 100 machines, 95 others carried out a training flight on Wednesday last week. Five squadrons of Wellingtons, one carrying Capt. H. Balfour, Under-Secretary for Air, flew to Marseilles and back in 8¼ hours. Two squadrons of Whitleys flew to a point of about 120 miles south of Paris, while several squadrons of Blenheims made a circuit which included Paris, Orleans and Chartres.

Reserve Mobilisation Exercises

A NUMBER of Royal Air Force Reservists are being called up during the next three to four months as a test mobilisation exercise; and certain units will carry out mobilisation and movement exercises during this period.

The Reservists affected would have been called up for annual training at this time in the ordinary course, and the special powers conferred by the Reserve and Auxiliary Forces Act, 1939, are not being used.

The exercises are being carried out in conjunction with Naval and Air Force exercises and Army manœuvres in July, August and September respectively.

The Militiamen Arrive

THE first batch of militiamen was received by the R.A.F. on July 17. During the first two months of the calling up the R.A.F. will have a quota of 2,000, to be received at the rate of 125 a day on four days of the week. The first batch was received at West Drayton, whence they travelled to Uxbridge for their uniforms, returning to West Drayton to collect their kit before departing to their allotted stations.

The first batches are comprised of ground personnel; men for the air sections will not be called up until later in the year. The militiamen will be supernumerary to the squadron strengths (each station will receive about 100) but they will be treated as ordinary members of the units.

The Cranwell Inspection

THE passing-out inspection of cadets of the R.A.F. College, Cranwell, will take place to-morrow, Friday, July 28, and not to-day as originally announced. The Inspecting Officer will be Gen. Lord Gort, V.C., Chief of the Imperial General Staff.

Barrage Balloons in London

BARRAGE balloons will be flying for training purposes at certain points in the London area within a radius of approximately seven miles of London Bridge during the period July 28 to August 5. They will fly both by day and night up to heights of 2,000ft. above sea level. The exercises form part of the training of balloon detachments.

The Air Force List

THE July issue of the *Air Force List* has now been published. It can be purchased (price 4s.) from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh; 2, York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square, Belfast; or through any bookseller.

Recruiting

THE Air Ministry announces that 693 recruits joined the Royal Air Force during the week ending July 15, compared with 602 in the corresponding period of last year. This brings the total entry of pilots, observers, airmen and boys since April 1 this year to 13,655. The corresponding figure for the same period last year was only 5,894.

New R.A.F.V.R. Centres

NEW centres for the recruitment and training of personnel of the R.A.F. Volunteer Reserve will shortly be opened at Carlisle, Doncaster and Norwich. The centre for Carlisle will be associated with No. 38 Elementary and Reserve Flying Training School at Carlisle aerodrome; No. 47 Elementary and Reserve Flying Training School at Doncaster will be the aerodrome for the Doncaster Town Centre; and the centre for Norwich will be associated with No. 40 Elementary and Reserve Training School at Norwich Aerodrome.

Eligibility of National Service Volunteers

ARRANGEMENTS have been made in consultation with the Ministry of Labour and the Commissioners of the Civil Air Guard whereby persons of sufficient flying experience will no longer be excluded by the Schedule of Reserved Occupations from joining the Auxiliary Air Force or the Royal Air Force Volunteer Reserve as pilots, or becoming members of the Civil Air Guard.

Persons with such experience who volunteer to join one of these services should state that they have had previous flying experience on the form E.D. 60 when submitting it to the Ministry of Labour (copies of this form may be obtained from any Employment Exchange or Post Office). They should also state (1) whether they hold an Air Ministry "A" Licence (and, if so, the number of hours solo flying experience they have had) and whether they also hold a "B" Licence, and (2) whether they have at any time served as pilots with the Royal Air Force, its Reserves or Auxiliaries. This information will ensure that a proper assessment is made of the value of their previous flying experience.

SERVICE AVIATION (CONTINUED)

Royal Air Force Gazette

Royal Air Force

General Duties Branch

Group Capt. J. W. Cordingley, C.B.E., is appointed Director of Manning, Air Ministry (July 17): Flt. Lt. W. A. Theed is granted a permanent commission in that rank (June 6); A. B. Tucker (from Reserve) is granted a short-service commission as Pilot Officer on probation for six years on the active list (July 1).

The following Pilot Officers on probation are confirmed in their appointments on the dates stated: J. M. Morgan, J. H. Ward (June 13); D. C. Colebrook, C. A. S. Greenhill (July 9).

Acting Pilot Officer on probation R. E. Hunter is confirmed in his appointment and graded as Pilot Officer (March 31).

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation (June 27): O. B. Morrogh-Ryan, E. W. Whitaker.

The following Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated: P. Ruston (Acting Flight Lieutenant) (April 13); A. J. Young (July 14).

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated: R. W. Turner, W. N. Perioli (June 16); T. Preston, P. R. Hatfield (June 18); P. D. Dear, A. K. Furse (June 21); M. A. Goodwin (June 23); R. A. Towgood (July 4); G. C. Matheson, J. S. Young, E. W. Campbell Colquhoun, E. A. Good, T. A. Cox, F. W. Snell (July 12).

The following Flying Officers are granted the acting rank of Flight Lieutenant on the dates stated: J. MacDougall (Lieutenant, Duke of Cornwall's Light Infantry), H. W. Tennant (March 2); D. E. C. Trench (May 8); P. F. Edinger (May 11); A. K. Hunter (May 16); P. J. S. Shaughnessy (May 20); V. A. Pope (May 26); D. J. H. Lay, D.F.C. (May 27); H. St. G. Turner (May 29); R. N. Cook, R. Williams, C. G. Master, P. G. D. Taylor, P. R. Woodward, D. F. H. Brown (June 1); W. Townson, J. W. Allsop (June 16).

The following Pilot Officers are granted the acting rank of Flight Lieutenant on the dates stated: G. Tanner (June 1); P. F. Murch (June 22).

The following Flying Officers relinquish the acting rank of Flight Lieutenant on the dates stated: J. B. Flowerdew (June 1); P. G. D. Taylor (June 15); R. S. J. Edwards (June 27); A. L. Pitfield (July 4).

Sqn. Ldr. C. A. H. B. Wilcock, A.F.C. (R.A.F. Ret.) is granted the honorary rank of Wing Commander (May 11); Group Capt. J. B. Graham, M.C., A.F.C., is placed on the retired list at his own request (July 1); Sqn. Ldr. C. Boumphrey, D.F.C., is placed on the retired list on account of ill-health (July 8); P/O. C. S. Kearey resigns his short-service commission (June 25); F/O. A. A. N. Breckon relinquishes his short-service commission on transfer to the Royal New Zealand Air Force (June 17); the short-service commission of Acting Pilot Officer on probation E. Galitzine is terminated on cessation of duty (July 11); P/O. J. Tudor-Evans is removed from the Royal Air Force (Dec. 6, 1938).

Equipment Branch

The following Flying Officers are promoted to the rank of Flight Lieutenant (April 14): R. A. Howes, M.B.E.; A. E. Harbot, M.B.E.; H. C. Adams; H. W. C. Springham; R. W. Wallace (Acting Flight Lieutenant); C. H. E. Lyster, M.B.E. (Acting Flight Lieutenant); E. J. Smith (Acting Flight Lieutenant); R. C. V. Ash (Acting Flight Lieutenant); D. F. Syder (Acting Flight Lieutenant); H. E. Bethell; H. Wood, M.B.E.; W. G. R. Jarman; T. J. Kinna; T. King (Acting Flight Lieutenant); W. MacI. King (Acting Flight Lieutenant); A. Selby (Acting Flight Lieutenant); A. H. McM. Hely (Acting Flight Lieutenant); G. I. Rees (Acting Flight Lieutenant); P. G. Bullen (Acting Flight Lieutenant); J. G. B. O'Hagan (Acting Flight Lieutenant); E. H. Free; L. Doyle; B. H. Alder; A. C. Dibben; C. D. P. Franklin (Acting Flight Lieutenant); S. G. Walker (Acting Flight Lieutenant); H. M. C. Harwood (Acting Flight Lieutenant); H. Stones (Acting Flight Lieutenant); L. C. Dennis (Acting Flight Lieutenant); K. D. Stanion.

The following Flying Officers are granted the acting rank of Flight Lieutenant on the dates stated: C. J. Salmon, K. T. Nicklin, R. F. Folley, D. H. M. Graham, F. G. C. Gilbert (April 14); F. B. King (April 28); F. P. Dawson (May 1).

The short service commission of Acting Pilot Officer on probation J. H. Ingram is terminated on cessation of duty (April 17); the notification in the *Gazette* of April 25 concerning F/O. R. A. Howes, M.B.E., is cancelled; the notification in the *Gazette* of May 19 concerning F/O. A. E. Harbot, M.B.E., and H. C. Adams is cancelled.

Accountant Branch

Flying Officer on probation G. B. Howard, M.M., is confirmed in his appointment (June 16).

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation (June 1): T. Alderson, S. P. Austin, J. B. Bennett, R. J. Bray, J. A. Bryden, W. A. Covill, J. R. Cox, F. E. Crosland, R. H. Harris, F. D. Holmes, R. R. Jack, A. Lees, D. H. Mortimore, R. Pilsbury, J. A. T. Plummer, P. Raby, J. H. C. Russell, R. J. Sharples, S. C. Tapley, R. B. Thomas, W. B. H. Vidgeon, R. D. White.

The following Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated: J. S. B. Anderson (Acting Flight Lieutenant), G. L. Seabrook (Acting Flight Lieutenant), G. A. Linn, W. N. Hibbert (Acting Flight Lieutenant), R. C. S. Allin (Acting Flight Lieutenant), A. Gollan (Acting Flight Lieutenant), P. J. Holt, H. E. J. Acfield (April 14); F. H. Shutt, H. C. Fleming (June 12).

Pilot Officer on probation P. H. Baker is confirmed in his appointment and promoted to the rank of Flying Officer (June 10).

The following Flying Officers are granted the acting rank of Flight Lieutenant on the dates stated:—C. W. S. Jones, S. M. MacIldowie, P. S. Gee, T. P. F. Trudgian (April 14); W. J. Evans (May 9); P. H. Reason, R. P. Burtt, J. L. Sanderson, B. T. Procter, J. B. Denning, H. S. Maurice-Jones, H. R. Tredinnick, R. P. Bennett (June 11); S. M. MacIldowie (June 12).

F/O. S. M. MacIldowie relinquishes the acting rank of Flight Lieutenant (June 5).

Medical Branch

The following Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated.—K. C. P. Smith, M.R.C.S., L.R.C.P. (May 2); S. Kent, M.R.C.S., L.R.C.P. (seny. May 18, 1938) (May 18).

Flt. Lt. E. J. Moynahan, M.R.C.S., L.R.C.P., is transferred to the Reserve, class D (July 8).

Commissioned Engineer Officers

The following Warrant Officers are granted commissions as Flying Officers on probation with effect from July 3 and with seny. of June 12:—A. J. Haskell, A. S. Kerr.

The following Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—F. G. Hammond, W. J. Loughhead, D. H. Newton, M.B.E., W. R. Mayes, D.S.M., A.F.M., C. W. Baker, M.B.E., V. J. Casey, H. E. Newing, P. McDiarmid, A.F.M., H. Hipwood, M. Downer, S. W. Birch, J. H. Tuckey, H. J. Sanders, E. J. A. Knight, T. Griffiths, B. H. Rolles, H. R. Clowes, W. H. King, A. J. Nicholas, J. K. Tough, J. C. Steadman, E. L. Magrath (April 14); C. T. McKnight (seny. April 14) (April 22); A. C. Oatway (seny. April 14) (April 26).

The notification in the *Gazette* of April 25 concerning F/O. F. G. Hammond is cancelled.

Commissioned Signals Officers

The following Flying Officers on probation are confirmed in their appointments on the dates stated:—R. H. Thomas (June 9); W. E. Dunn (June 13); C. N. Williams, L. Avery (June 30).

The following Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—F. Wilmshurst, D.S.M., W. G. Swanborough, M.B.E. (Acting Flight Lieutenant), J. R. Welsh, A.F.M., R. K. Nicholas, P. Allerston, A. W. Daniels, C. Turl, D.S.M., F. W. G. Aggett, M.B.E. (April 14); A. W. Coe (seny. April 14) (April 16); F. W. Jenkins (seny. April 14) (July 1).

Commissioned Armament Officers

Flying Officer on probation R. Hazelwood is confirmed in his appointment (June 2).

The following Flying Officers are promoted to the rank of Flight Lieutenant:—R. H. Garner, R. B. Cleaver, G. Bird, J. Heffernan, A. J. Richardson, L. A. Bett (April 14).

Commissioned Photography Officer

F/O. F. C. Crowdy is promoted to the rank of Flight Lieutenant (April 14).

Commissioned Physical Training Officer

F/O. E. J. Bradbury is promoted to the rank of Flight Lieutenant (April 14).

Errata

In the *Gazette* of June 23 for Vincent Oswold M'Quillin read Vincent Oswald M'Quillin; in the *Gazette* of July 4 for Leonard Richard Robinson read Lincoln Richard Robinson.

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS.

General Duties Branch.

Flt. Lt. T. Rose, D.F.C., is granted a commission in class C as Flight Lieutenant with effect from July 4 and with seny. of October 23, 1934; R. W. Reid is granted a commission in class C as Flying Officer, with effect from June 27 and with seniority of May 11, 1937; C. E. Kelly is granted a commission in class C as Flying Officer with effect from July 5 and with seny. of July 5, 1927; Brig. J. C. Gretton, C.B. (I.A. Ret.), is granted a commission in class CC as Wing Commander (April 17); Lt. Col. (Bt. Col.) R. F. Nation, O.B.E., is granted a commission in class CC as Flight Lieutenant (Honorary Squadron Leader) (April 3); Lt. O. S. Hinson is granted a commission in class CC as Flight Lieutenant (May 22); Lt. P. S. V. Smith (R.N. Ret.) is granted a commission in class CC as Flight Lieutenant (May 24); Maj. H. F. Anns is appointed to a commission in class CC as Flight Lieutenant (Honorary Squadron Leader) with effect from September 1, 1938, and is granted the rank of Squadron Leader with effect from December 1, 1938. (Substituted for notification in the *Gazette* of June 23); W. H. G. Heath (Lt. R.A. Ret.) is appointed to a commission in class CC as Flight Lieutenant with effect from February 27 and is granted the honorary rank of Squadron Leader with effect from April 1; Flt. Lt. F. W. Murison (R.A.F.O.) is appointed to a commission in Class CC as Flight Lieutenant with effect from March 26 and is granted the honorary rank of Squadron Leader in that class with effect from April 1; Maj. P. C. A. Bridgeman, O.B.E., is granted a commission in Class CC as Flying Officer (Honorary Squadron Leader) from

SERVICE AVIATION (CONTINUED)

May 8 to June 20, inclusive; F/O. J. H. Leach is granted a commission in Class CC as Flying Officer (March 23); Lt. Cdr. Sir H. A. Colt, Bt., D.S.O., M.C. (R.N. Ret.), is granted an honorary commission in Class C as Flying Officer (May 16); Flt. Lt. H. C. Tallboy is granted the rank of Squadron Leader (May 30); Flt. Lt. W. H. Day is granted the rank of Squadron Leader (June 1); F/O. (Act. Flt. Lt.) C. B. Dove is granted the acting rank of Squadron Leader in Class CC (May 6); Flt. Lt. R. E. Hall (R.A.F.O.) is granted the acting rank of Squadron Leader in Class CC (May 22); Flt. Lt. J. A. Ferguson, O.B.E., is granted the honorary rank of Squadron Leader (April 1).

Equipment Branch

Flt. Lt. E. S. Bullen, M.B.E. (R.A.F. Ret.) is granted a commission in Class CC as Flight Lieutenant (May 8).

Royal Air Force Volunteer Reserve

General Duties Branch

H. D. Freakes is granted a commission as Pilot Officer (July 18); P/O. T. K. Walls is promoted to the rank of Flying Officer (June 19); Sqn. Ldr. A. D. R. Metaxa is granted the honorary rank of Wing Commander (May 11); F/O. A. B. Tucker relinquishes his commission on appointment to a short service commission in the Royal Air Force (July 1).

Administrative and Special Duties Branch

R. A. Smith is granted a commission as Pilot Officer on probation with the honorary rank of Flight Lieutenant (May 11).

The following are granted commissions as Pilot Officers on probation with the honorary ranks stated (July 11):—Flight Lieutenants: J. A. Birtwistle, E. N. Bullock, A. Hall, T. W. Hay, M. Jackson, I. C. T. Lupton. Flying Officers: A. Foden, W. H. Lamplough.

The following are granted commissions as Pilot Officers on probation (July 11):—C. L. Atkinson, B. G. Blampied, T. W. E. Brogden, G. F. C. Caswell, F. I. David, H. Edge, S. D. Felkin, M.B.E., J. L. Finney, E. O. Fuller, L. A. S. Harris, G. E. W. Hitchcock, L. B. Irish, G. H. Keat, H. J. Lewis, D. A. Parker, J. H. Reynolds, M.M., A. R. M. Scrase Dickins, J. R. Woods.

FOR GROUND DUTIES: Members of the newly formed Women's Auxiliary Air Force, whose uniform, of R.A.F. blue, was seen in public for the first time during the recent National Service Rally in Hyde Park. Miss J. Trefusis Forbes has been appointed Director of the W.A.A.F.

Medical Branch

The following are granted commissions as Flying Officers (July 18):—W. C. Baird, M.R.C.S., L.R.C.P.; B. M. Merriman, M.R.C.S., L.R.C.P.; W. K. Stewart, M.B., Ch.B.

Dental Branch

The following are granted commissions as Flying Officers (July 18):—G. H. H. Ames, L.R.C.P., M.R.C.S., L.D.S.; J. Booth, L.D.S.; H. C. Davis, L.D.S.; C. R. Dawson, L.D.S.; R. D. G. Gain, L.D.S.; G. R. Pidgeon, L.D.S.; H. W. Walker-Smith, L.D.S.; P. D. Wharton, L.D.S.; R. A. F. Williams, L.D.S.

Auxiliary Air Force

General Duties Branch

No. 504 (COUNTY OF NOTTINGHAM) SQUADRON.—Act. P/O. E. M. Frisby is confirmed in his appointment and graded as Pilot Officer (May 14).

No. 604 (COUNTY OF MIDDLESEX) SQUADRON.—The following are granted commissions as Acting Pilot Officers (June 25):—J. K. S. Joll, A. C. Maclaren.

No. 607 (COUNTY OF DURHAM) SQUADRON.—Sqn. Ldr. the Hon. W. R. Runciman, A.F.C. is appointed Hon. Air Commodore (June 2); Lord Londonderry, K.G., M.V.O., relinquishes his appointment as Hon. Air Commodore of this squadron (June 2); F/O. M. M. Irving relinquishes his commission (March 10).

No. 609 (WEST RIDING) SQUADRON.—P/O. A. R. Edge is promoted to the rank of Flying Officer (December 22, 1938); Act. P/O. A. J. Blayney is confirmed in his appointment and graded as Pilot Officer (May 4).

No. 611 (WEST LANCASHIRE) SQUADRON.—F/O. J. W. Carmichael is transferred to No. 600 (City of London) Squadron (July 6).

No. 612 (COUNTY OF ABERDEEN) SQUADRON.—The following are granted commissions as Acting Pilot Officers (June 15):—J. T. Raffan, D. A. Sadler.

No. 901 (COUNTY OF LONDON) SQUADRON.—F/O. A. R. Hind is transferred to the Equipment Branch (March 20).

No. 903 (COUNTY OF LONDON) SQUADRON.—L. F. Thurlow is granted a commission as Acting Pilot Officer (July 3).

No. 910 (COUNTY OF ESSEX) SQUADRON.—F/O. F. R. Alford relinquishes his commission (Feb. 27).

No. 918 (COUNTY OF DERBY) SQUADRON.—Sir J. A. Aiton, Kt., C.B.E., J.P., is appointed Hon. Air Commodore (July 18).

No. 920 (WEST LANCASHIRE) SQUADRON.—I. A. Macaulay is granted a commission as Acting Pilot Officer (July 3).

No. 922 (WEST LANCASHIRE) SQUADRON.—J. H. Musker is granted a commission as Acting Pilot Officer (May 30).

No. 928 (COUNTY OF GLOUCESTER) SQUADRON.—K. C. M. Stock is granted a commission as Acting Pilot Officer (June 30).

No. 929 (COUNTY OF GLOUCESTER) SQUADRON.—E. L. Bickle is granted a commission as Acting Pilot Officer (July 6).

No. 932 (HAMPSHIRE) SQUADRON.—J. A. Grafton is granted a commission as Acting Pilot Officer (July 6).

No. 947 (CITY OF GLASGOW) SQUADRON.—T. Barclay is granted a commission as Pilot Officer (April 17).

Equipment Branch

Flt. Lt. W. H. G. Heath relinquishes his commission on cessation of duty (Feb. 27).

Medical Branch

No. 930 (HAMPSHIRE) SQUADRON.—E. O. Walter M.B., B.Chir., M.R.C.S., L.R.C.P., is granted a commission as Flying Officer (July 3).

Auxiliary Air Force Reserve of Officers

General Duties Branch

M. M. Irving is granted a commission as Flying Officer in Class A with effect from March 10, and with seniority of September 10, 1935.

Flying Accidents

THE Air Ministry regrets to announce the following flying accidents:—

F/O. David Ivan Jobson, Sgt. John Archibald Hawes, Sgt. Ernest Walter Jones, and A/C.2 Ronald James Andrews, lost their lives in an accident which occurred at Corby, Lincolnshire, on July 18, to an aircraft of No. 44 Squadron.

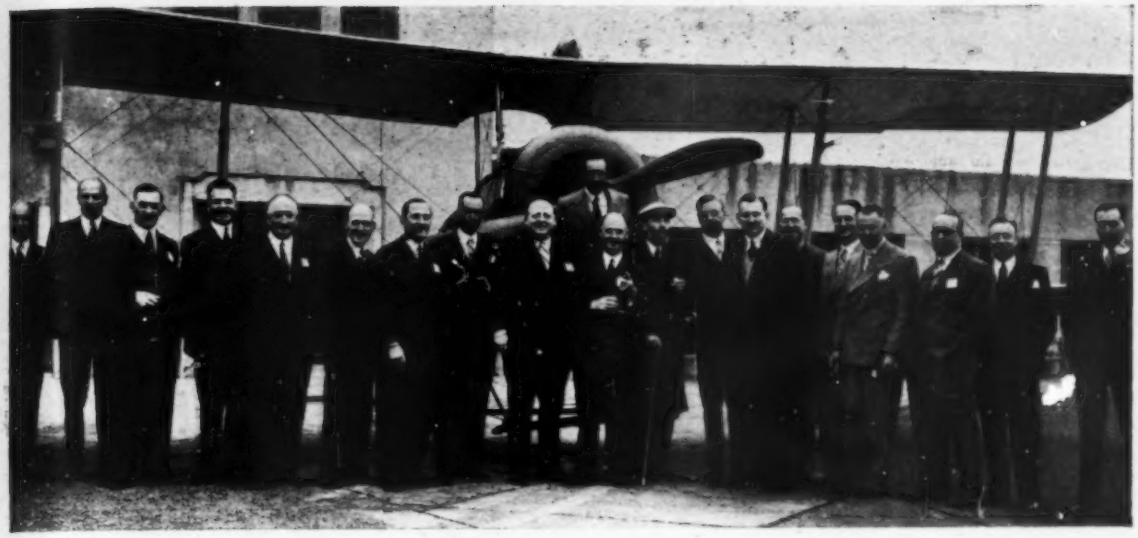
Sgt. Kenneth Mitchell (flying solo) lost his life in an accident which occurred at Appleby, Westmorland, on July 18 to an aircraft of No. 41 Squadron.

P/O. George Buchanan Baker, P/O. Joseph Murray Brockbank, and Sgt. Phillip Mealing lost their lives in an accident which occurred at Scarborough on July 21 to an aircraft of No. 166 Squadron.

Sgt. Jack Arnold Bullard lost his life in an accident which occurred on July 21 near East Wittering to an aircraft of No. 23 Squadron. Sgt. Bullard was the pilot of the aircraft; Mr. Denis Nahun, the only other occupant, was uninjured.

Mr. David Curig Lewis, Mr. Keith Kendle Brown and Mr. Alan Pragnell lost their lives as the result of a collision in the air which occurred near Sandwich, Kent, on July 21, 1939, between an aircraft of the Oxford University Air Squadron and one from Bekesbourne Civil Flying School. Mr. Lewis was the pilot and sole occupant of the R.A.F. machine and Mr. Brown was the pilot and Mr. Pragnell the passenger of the civil aircraft.

Lt. David Marsh Lloyd, Royal Navy (flying solo) lost his life in an accident which occurred at Skipsea on July 21 to an aircraft of No. 1 Flying Training School.



The Second Gosport Reunion at Brooklands : Standing in front of the Avro 504 are Col. Smith-Barry and Capt. Balfour. Between them is Col. George Philippi, and standing on the skid of the Avro is Wing Cdr. Ham[illegible]ersley, now chief instructor of the London University Air Squadron. On the extreme left is Group Captain Robb, Commandant of the C.F.S.

The Gosport Reunion

THAT Capt. Duncan Davis was inspired when, last year, he conceived the idea of gathering together at a reunion dinner at Brooklands as many as possible of those who served at the original Gosport school of flying instruction was confirmed last Saturday, when more than 30 old Gosportians met again at Brooklands at his invitation to meet their old C.O., Col. R. R. Smith-Barry. The Under-Secretary of State for Air, Capt. Harold Balfour, arrived at Brooklands in a Percival Vega Gull, and spent an hour or so with the party, although he was not able to remain for the dinner and left for some destination in the Eastern Counties in conditions of very poor visibility.

It is not, perhaps, generally known that our young and very energetic Under-Secretary has, among his many other distinctions, that of having been through Gosport. His interest in the old card index on which the reports on all Gosport pupils were kept, and which someone had managed to dig up from the archives, was as keen as anyone's, and he more than held his own in the leg-pulling which inevitably accompanied the perusal of the reports. On Saturday Capt. Balfour left the Under-Secretary of State for Air behind him at the Air Ministry, and was just one of the old Gosport boys.

Col. Smith-Barry caused some little anxiety by not arriving until just before 8, the hour set for the dinner, as no one was quite certain whether he would arrive by air or by road. However, ultimately he turned up in a car. When this was seen approaching there was some little doubt as to whether the driver was indeed "S.-B." But when the car cut across the corner of the aerodrome by the Hawker shed instead of following the more orthodox way around, the cry went up unanimously "That's the Colonel, all right!"

Col. Smith-Barry expressed thanks to Capt. Duncan Davis and to Mr. Nepean Bishop for their good work in getting so many old Gosport instructors together. Many had come from afar, although not quite so far as Norman Brearley last year, who came all the way from Australia, the farthest it was possible to travel unless one "went the wrong way around."

The British Label

Primary flying training, the Colonel said, can never change, and so the fundamental principles laid down at Gosport still held good. At Gosport they were taught to fly by the feel of the machine. Instrument flying, which was now being so greatly developed, was all very well, but the time came when the machine had to be handled near the ground, and proficiency near the ground was what he wanted to see, not stunting. That proficiency seemed peculiar to British pilots, and the Colonel recalled overhearing an American telling, on a steamer en route to New York, a story of a forced landing he had successfully pulled off. When the colonel asked him for particulars he answered quite seriously, "Oh, yes, it is different for you, you are English." On another occasion a German pilot had said to him after he landed, "I knew you were English by the way you were flying." Col. Smith-Barry explained that he had "merely landed in front of the shed."

Col. Smith-Barry recalled that, when he joined, the flat turn was the only one permitted. His probationary period was considerably lengthened by his insistence on doing banked turns near the ground, and he had to practise surreptitiously. He invented the sideslip landing and the cross-wind landing, and was nearly arrested for practising them! Proficiency near the ground gave that very important thing they had at Gosport: a superiority complex. The Colonel then explained that he was bringing his knowledge up to date by taking an instructor's course under Ken Waller. To the outburst of laughter which followed this statement "S.-B." replied: "No, no, don't make any mistake; I am quite serious; Waller is teaching me a great many things."

Group Captain J. M. Robb, Commandant of the Central Flying School, referred to himself as "head nursemaid of the present generation" (the Colonel had said that primary flying instruction did not change, just as it was the nursemaid's job to teach the infant to walk, even if in later years it decided to travel along the road at 100 m.p.h.) and pointed out that the basic principles established at Gosport held good to-day. The C.F.S. was the guardian of the Gosport tradition, and they had not changed anything merely for the sake of changing. If one compared the "patter" of the present time with the Gosport variety, it was found that the wording was different, but the principle the same. In modern times they were faced with certain difficulties which did not exist at Gosport. It was becoming very difficult to find, in our crowded England, any suitable low-flying area. Then there was the problem of congestion in the air, and the use of many different types of aircraft. As a result the Air Council had laid it down that aerobatics were not to be carried out below 3,000ft.

Mr. Watson asked permission to give the civilian point of view. At Gosport they were taught to fly without instruments. That was a most valuable lesson.

Aged in the Wood

Lt. Col. George Philippi agreed with Mr. Watson that "S.-B." taught much more than flying. Among other things, he taught them how to get things, without enquiring too closely how! He told a good story of a prominent French air officer who visited England recently and went to Oxford, where he saw some of those wonderful lawns he had heard so much about, and was told how we produce a lawn by cutting the grass, rolling, cutting and rolling, until, after about 400 years, we had a lawn. "And so with your aerodromes," said the French officer, "you are marvellous at making aerodromes. You fell trees and fill ditches, and then fell more trees and fill more ditches, and in 400 years you will have an aerodrome."

Capt. Rex Stocken proved himself an excellent raconteur by giving, largely in French, his impressions of his first visit to French aerodromes during the war as a teacher of the Gosport system in France. The first time he landed at Le Bourget in a 504 the commandant rushed out and congratulated him on his escape from certain death by "*just* managing to right the machine in time." He had merely made a normal Gosport-type sideslip landing close to the hangar. His account of a visit to a French flying school was a perfect gem. The pride of the French instructor when the pupil demonstrated aerobatics, and the culminating tragedy when he finished by spinning into the ground, were related with the verve of a professional actor.

It is to be hoped that next year an even greater number of old Gosport instructors will attend the reunion, and we would ask anyone who happens to read this, and is either himself an old Gosportian or knows where one now lives, to get in touch with Capt. Duncan Davis at Brooklands, who has inevitably lost track of many who are entitled to attend this thoroughly commendable function.

C. M. P.

FOKKER DEVELOPMENTS: The tandem-engined Fokker D.23 single-seater fighter (above) is now doing its initial test flights. Some information on the machine appears on this page. The prototype has Walter Sagittas, but the much more powerful Rolls-Royce Merlins or Daimler-Benz 601s may later be fitted. On the right is the reconnaissance version of the G.1 (two Mercuries), showing the observation compartment.

FOREIGN SERVICE NEWS

Fokker's New Fighter

A FEW hours' flying have been put in on the Fokker D.23 single-seater fighter first introduced at the last Paris Show. It may be recalled that this is a twin-engined, mid-wing cantilever machine with the engines arranged in tandem, the tail being carried on two booms. The undercarriage is a retractable tricycle.

Although the prototype is being flown with Walter Sagitta engines with a maximum output of 528 h.p. each, the new Isotta Fraschini Delta inverted vee-twelve can be specified or even Rolls-Royce Merlins or Daimler-Benz D.B.-601's of over 1,000 h.p. each. The estimated top speed with the Sagittas is 325 m.p.h.; 360-370 m.p.h. should be easily obtained with the Rolls-Royce or Daimler-Benz engines.

Normally the armament consists of two Browning-F.N. synchronised guns of 7.9 mm. calibre and two 13.2 mm. weapons firing explosive bullets, though these latter may be replaced with 20 or 23 mm. shell-guns.

Vultee Twin Fighter

A TWIN-ENGINED single-seater fighter is now on the drawing boards of the Vultee concern. It is said that this machine could be in production in eighteen months, but that it would cost slightly more than the Lockheed type (which won an experimental contract from the U.S. War Department) though it will be 3 m.p.h. slower.

The Dutch Dorniers

THE first of the Dornier Do. 24 flying boats (three Wright Cyclones) built under licence in Holland by Aviolanda for the use of the Dutch Navy in the East Indies made its first flight about two weeks ago. Six Do. 24s are already in service, but these were built at the Dornier works at Friedrichshafen. One of these boats flew about 7,450 miles in the Archipelago in five days, chiefly during the hours of darkness.

Finnish Fighter

A NEW design of all-Finnish fighter is being introduced by the Finnish State Aircraft Works. Bearing the type name Pyry, the new machine has a top speed of 211 m.p.h. and cruises at 185 m.p.h. It reaches 370 m.p.h. in a dive. With a Wright Whirlwind engine the machine climbs to 6,560ft. in 5 min. 18 sec. and to 9,840ft. in about 9 minutes, the service ceiling being 19,685ft. An important fact is that the Pyry can be produced at about half the cost of an imported machine of similar size, equipment and performance. Obviously, it would be of little use as a first-line machine, but might make a good trainer.

Service Training at U.S. Civil School

THE U.S. Army Air Corps is starting a scheme for *ab initio* flying training at commercial schools, following the British system, and the first batch of 35 cadets has gone to the Ryan School of Aeronautics at Lindbergh Field, San Diego.

The Ryan Company, incidentally, has just received an order from the U.S. Army Air Corps for a number of special versions of its two-seater, low-wing monoplane trainer.

Further Swedish Expansion

OBVIOUSLY as a result of Maj. Alexander de Seversky's recent visit to Stockholm a contract for 15 Seversky fighters has been placed by the Swedish Government. This is but one manifestation of Sweden's expansion, which will entail the expenditure of 40 million kroner during the coming fiscal year.

Two new squadrons—F.6 and F.7—have been established in West Sweden. These will be equipped with machines built under licence, F.6 having Northrop 8A.1 single-engined bombers and F.7 being equipped with the twin-engined Junkers Ju.86K.

"Hush-hush" Pratt and Whitney

THE U.S. Army and Navy have co-operated with the Pratt and Whitney concern in developing an 18-cylinder two-row radial weighing slightly more than 1 lb. per horse power. Before being sent to the Materiel Division of the U.S. Army Air Corps the unit underwent more than 3,000 hours' running. It is stated that this is the most powerful engine ever to pass the American Government test of 150 hours. Despite this, however, the diameter is the same as that of the original 400 h.p. Wasp (about 50½ in.).

Defence Against Low-flying Attacks

LT. COL. MALVANI, writing in *Rivista di Fanteria* on the subject of machine-gun defence against low-flying aircraft, states that, in view of the short time an aircraft is under fire, it is essential that the gun control be as simple as possible. The best results are obtained by putting up a barrage through which the attacking machine must fly, but the gunner must know when to open fire and the angular lead required. If tracer ammunition is employed the sight is only used for the first burst. The mixing of tracer and ordinary S.A.A. is not recommended.

It must be remembered that the aircraft will drop its bomb whilst still some distance from the target and the barrage must be placed accordingly. During a typical practice "shoot" against a towed target, at a distance of 360ft., twelve hits were scored out of a burst of 445 rounds.

THE ROYAL AERO CLUB

News and Official Notices for *the Week Ended July 22*

German Air Law

UNIFICATION of air law and general procedure for dealing with all aircraft matters throughout the Greater Reich is proceeding rapidly. In pursuance of the decree about the incorporation of Austria and the Sudeten areas into the German Reich, a second ordinance has been issued laying down that the German laws relating to various aviation matters are now in force in Ostmark and the Sudeten German areas.

Germany is not a signatory to the International Convention for Air Navigation and in consequence she is able to regulate internal traffic without reference to international methods if she wishes. In general, however, German air law conforms in principle to that of international air law. Although Germany is not a signatory to the Convention, numerous agreements between her and other countries are in force which take the place of the Convention.

Model Tea

A RECEPTION at the Royal Aero Club was held on Friday, July 21. It was a tea for some 100 competitors comprising the eight national teams who had entered the model glider competition for the cup presented by King Peter of Yugoslavia. The teams were given tea in the large dining room overlooking Piccadilly. Large numbers of new models have been constructed for these competitions and in the Club entrance hall there stood many cases containing models forwarded from abroad. The teams were received at the Royal Aero Club by the Chairman, Sir W. Lindsay Everard, M.P., and by Dr. A. P. Thurston, President of the Society of Model Aeronautical Engineers.

Deauville Record

NEARLY 200 entries for the Deauville and Plantagenet Air Rallies in France had been received at the closing date this week. The Deauville Rally has proved in the past to be one of the most popular events with British private owners and this year the entry lists showed no fewer than 65 different aeroplanes.

The Plantagenet Rally was being held for the first time. The events will be followed this coming week-end by the Deauville-Vichy-Cannes Rally, organised by the Cannes Aero Club, and the Frankfurt International Flying Meeting.

Gliding Contests

A GENERAL view of the National Gliding Contests which were concluded at Great Hucklow near Buxton on July 16, is that big steps in both the popularity and the technique of soaring have taken place during the past twelve months. In spite of very poor weather with low clouds and often rain, some remarkable flights were made. They included a flight to the sea of 160 miles, the longest ever made during a National Gliding Contest, by Mr. Christopher Nicholson, who came out first in the final results, closely followed by Mr. P. Wills; and a batch of 16 cross-country flights all made in one day and covering an aggregate of 583 miles. Mr. Nicholson flew from Great Hucklow to Southend airport, where he landed six hours later. On the way his greatest height was 5,000ft. above the level of his starting point. He passed through 15 different clouds during the journey but was never flying blind for more than 10 minutes at a time.

Aviators' Certificates

No.	Name	Club or School	Date
19,026	Samuel William Chance	Airwork Flying Club ...	10.7.39
19,027	Harold Easton Shepperd ...	Airwork Flying Club ...	10.7.39
19,028	Benjamin Lewis Byrom	Lancashire Aero Club ...	10.7.39
19,029	Cyril Tuxworth	Lincolnshire Aero Club...	11.7.39
19,030	Guy Butterfield	Lincolnshire Aero Club...	11.7.39
19,031	Cyril George Yarnold	Northern Aviation Club...	11.7.39
19,032	Neville St. John Jacobs	Isle of Wight Flying Club	11.7.39
19,033	John Coggins	Ipswich Aero Club ...	11.7.39
19,034	Brian Edward Lymbery	No. 20 E. and R.F.T.S., Gravesend.	11.7.39
19,035	Francis William Seed	Blackpool and Fylde Ae.C.	11.7.39
19,036	Cyril Walton	Blackpool and Fylde Ae.C.	11.7.39
19,037	Thelma Margaret Biddlecombe ...	Malling Aero Club ...	12.7.39
19,038	Ralph Richmond Brown	Herts and Essex Ae. C....	12.7.39
19,039	William Rayner Sharp	Thanet Aero Club ...	12.7.39
19,040	Robert Trevan Hargreaves ...	Southend Flying Club ...	12.7.39
19,041	Ronald Guy Woolf	Southend Flying Club ...	12.7.39
19,042	Stanley Seward Marples	Kent Flying Club ...	12.7.39
19,043	Robert Thomas Woods	Hampshire Ae. C. ...	12.7.39
19,044	John Seymour Gelston	Horton Kirby Flying Club	12.7.39
19,045	Edward Franklin Cragg	Horton Kirby Flying Club	12.7.39
19,046	Ernest Bramhall	Doncaster Aero Club ...	12.7.39
19,047	Edward Arthur Sibbick	Isle of Wight Flying Club	12.7.39
19,048	Arthur Basil Holden	Plymouth and Dist. Ae. C.	12.7.39
19,049	Albert Percival Clifford Rogers ...	Exeter Aero Club ...	12.7.39
19,050	Henry Kircher Knight	South Coast Flying Club...	13.7.39
19,051	John Orme Kerrison	South Coast Flying Club...	13.7.39
19,052	James Veitch	South Coast Flying Club...	13.7.39
19,053	Ronald William Brownbridge ...	York and Leeming F.C....	13.7.39
19,054	Alfred Claude Henning	Southend Flying Club ...	13.7.39
19,055	Frederick Claudius Barnes Waller	Southend Flying Club ...	13.7.39
19,056	Thomas William Clayton... ...	Hull Aero Club	13.7.39
19,057	Charles Vernon Kair	Hull Aero Club	13.7.39
19,058	George Harold Stothard	Hull Aero Club	13.7.39
19,059	Arthur Leighton Patterson ...	Romford Flying Club ...	13.7.39
19,060	Wilfred Earle Nixon	De Havilland School of Flying.	13.7.39
19,061	Norman William Hodgson ...	Reading Aero Club ...	14.7.39
19,062	Arthur George Vivian Bale ...	Cardiff Aeroplane Club ...	14.7.39
19,063	Reginald Bruce Copp	Cardiff Aeroplane Club ...	14.7.39
19,064	Edward Hayman Morrison ...	Autogiro Flying Club ...	14.7.39
19,065	John Wilfried Gaudioz	Airwork Flying Club ...	14.7.39
19,066	George Edward Shearmur ...	Airwork Flying Club ...	14.7.39
19,067	Thomas Staniforth Arrand ...	Doncaster Aero Club ...	14.7.39
19,068	Ronald Douglas Cockayne ...	Tollerton Aero Club ...	14.7.39
19,069	Jack Willmot	Bedford Aero Club ...	14.7.39
19,070	David James Davies	Bedford Aero Club ...	14.7.39
19,071	John Bone	Plymouth and Dist. Ae. C.	14.7.39
19,072	Reginald Walter Bridgman ...	Weston Aero Club ...	14.7.39
19,073	William Harold Watson	Strathtay Aero Club ...	14.7.39
19,074	William Thoms	Strathtay Aero Club ...	14.7.39
19,075	Gerald Davis Powell	Wiltshire Flying Club ...	14.7.39
19,076	Leonard George Bowhay-Saunders	Isle of Wight Flying Club	15.7.39
19,077	Henry Peter Allingham	Malling Aero Club ...	15.7.39
19,078	Eva Victoria Alexandra Hill ...	Cardiff Aeroplane Club ...	15.7.39
19,079	Robert Falcon Scott Lawrence ...	York and Leeming F.C....	15.7.39
19,080	Vivian Egerton Saunders... ...	Cinque Ports Flying Club	15.7.39
19,081	Helmut John Kaffka	Redhill Flying Club ...	15.7.39
19,082	Charlton Haw	York and Leeming F.C....	17.7.39
19,083	Laurence Frank Child	Luton Flying Club ...	17.7.39
19,084	Barry Robert Flury	Midland Aero Club ...	17.7.39
19,085	John William Comelio	Midland Aero Club ...	17.7.39
19,086	Donald Henry Gates	Midland Aero Club ...	17.7.39
19,087	Ernest Sturtevant Dence... ...	Midland Aero Club ...	17.7.39
19,088	Hugh Gabriel Aldis	Midland Aero Club ...	17.7.39
19,089	Alister Douglas Atkinson... ...	Midland Aero Club ...	17.7.39
19,090	Peter Max Lindner	Worcestershire F.C. ...	17.7.39
19,091	Thomas Henry Pithouse	London Transport F.C....	17.7.39
19,092	Joseph Henry Bayless	London Transport F.C....	17.7.39
19,093	Edgar Norman Smith	Midland Aero Club ...	17.7.39
19,094	Victor Broughton Sturge ...	Midland Aero Club ...	17.7.39
19,095	Hubert Redmill	Herts and Essex Ae. C....	17.7.39
19,096	Frederick Charles Crozier... ...	Herts and Essex Ae. C....	17.7.39
19,097	Albert George Howard	Southend Flying Club ...	17.7.39
19,098	Frederick Clifford House	Southend Flying Club ...	17.7.39
19,099	John Leslie Dowdeswell	Southend Flying Club ...	17.7.39
19,100	Eileen Annie Porter	County Flying Club ...	17.7.39
19,101	Cyril George Atherton	Norfolk and Norwich Ae.C	17.7.39
19,102	George Harman Baker	Southend Flying Club ...	17.7.39
19,103	Francis Harman Cheasley ...	Southend Flying Club ...	17.7.39
19,104	Jack Waller	Southend Flying Club ...	17.7.39
19,105	Francis Robert Wood	Hull Aero Club	17.7.39
19,106	Reginald Simpson Farmery ...	Hull Aero Club	17.7.39
19,107	Jean Rose	Airwork Flying Club ...	17.7.39
19,108	Horace Bertram Bath	Airwork Flying Club ...	17.7.39
19,109	Douglas John Robert Craig ...	Airwork Flying Club ...	17.7.39
19,110	Geoffrey John Seden	Lincolnshire Aero Club...	17.7.39
19,111	Charles William Hartop	Lincolnshire Aero Club...	17.7.39
19,112	Stanley Richard Atkins	Northants Aero Club ...	17.7.39
19,113	Kenneth Storey Morton	Newcastle Aero Club ...	17.7.39
19,114	Frank Heywood	Lancashire Aero Club ...	17.7.39
19,115	Lenox Atlas Thomas Hawker ...	Exeter Aero Club ...	17.7.39
19,116	George Rutherford Callingham ...	No. 23 E. and R.F.T. School Rochester	18.7.39
19,117	Donald McIntosh Gray	No. 21 E. and R.F.T. School, Stapletord.	18.7.39
19,118	John Walker Fowlie	Midland Bank Flying Club	18.7.39
19,119	William Gavin Naismith	Plymouth and Dist. Ae. C.	18.7.39
19,120	Alfred John Edward Finch ...	Southend Flying Club ...	18.7.39
19,121	James William Webber	Southend Flying Club ...	18.7.39
19,122	Peter Arthur Vere Dolleymore ...	London Air Park F.C. ...	18.7.39
19,123	John Joseph Walsh	Bristol and Wessex Ae. C.	18.7.39
19,124	Charles Frederick Brouncker ...	Horton Kirby Flying Club	18.7.39
19,125	Lesley Cairns Murray	Horton Kirby Flying Club	18.7.39
19,126	Ronald Arthur Robert Child ...	Luton Flying Club ...	19.7.39
19,127	Norman Clifford Lewis	Luton Flying Club ...	19.7.39
19,128	Douglas Arthur Wilkinson ...	Insurance Flying Club ...	19.7.39
19,129	James Greig McAughtrie	Scottish Flying Club ...	19.7.39
19,130	Donald Macdonald Bruce ...	Scottish Flying Club ...	19.7.39
19,131	Rowland Victor Rushton... ...	Northants Aero Club ...	19.7.39
19,132	Norris Victor Marshall	Redhill Flying Club ...	19.7.39
19,133	Vivian Olive St. Clair Maitland ...	Autogiro Flying Club ...	19.7.39
19,134	Lionel Jack Poulton	Wiltshire Flying Club ...	19.7.39
19,135	Marigold Deane-Drummond ...	Witney and Oxford Ae. C.	19.7.39

Learning to keep formation. Airspeed Oxfords are used to train pilots in flying twin-engined bombers.

SOUTH CERNEY

No. 3 FLYING TRAINING SCHOOL

By

MAJOR F. A. de V. ROBERTSON, V.D.

MODERN aircraft require more intelligence in the pilot and a higher physical standard than those of olden times; a higher standard of training is always the aim These, it may be stated, are among the sentiments which animate the Directorate of Training at the Air Ministry. In fact, it is hoped that considerable practice in real bad-weather flying, as apart from mere practice under the hood, may be given before long at the R.A.F. Flying Training Schools. Still, the work now carried out at each F.T.S. is really very remarkable, and its results are most admirable. I was able to study them during a recent visit to No. 3 F.T.S. at South Cerney.

This F.T.S. is no stranger to *Flight*, for our representatives visited it in 1933 when it was at Grantham. The school moved from there to South Cerney, in Gloucestershire, in August 1937. Of course, in six years, the whole personnel of the school has changed. Even a battalion of an Army regiment would have altered pretty considerably in that time, and the R.A.F. is far more prone to games of general post. In those six years the methods of training have altered almost as radically as has the personnel. In 1933 an F.T.S. received short-service officers and airman pilots from their disciplinary course at Uxbridge, and taught them to fly from the very beginning—I beg pardon, I should have written *ab initio*. It is a Government rule never to use an English expression if a classical, foreign, or jargon word can be found to mean the same thing. The course then took a year, and the instructors were inclined to question whether that time was long enough, for at the end of it the pupils could not do much more than fly Service types of aircraft, and had hardly a notion of squadron work. So after they had been posted to their squadrons their education had to be continued, and the first quarter of the squadron's training year had to be spent in what was called individual training. Expansion has changed all that. The course now takes only ten months all told, and at the end of it the pilot is able, at least in theory, to do his full job as an officer of a squadron. The squadrons say that that claim is very nearly correct.

When No. 3 F.T.S. was first formed it only trained eighteen pupils a year. Now it turns out about 100 every seven or eight months. There are ten of these schools in Great Britain and one in Egypt, to say nothing of Cranwell, which trains its own flight cadets, the numerous Volunteer Reserve schools, and the Auxiliary squadrons, which also train their own pilots.

The main points of the change of curriculum which came in with expansion were (1) to relieve the F.T.S. at the beginning of the course, and (2) to ask more from it at the end. The teaching of a pupil to fly an elementary type of aeroplane, together with some simple ground theory, is now carried out at a civilian school, known as an Elementary and Reserve Flying Training School. The pupils, consisting of officers about to receive short-service commissions, airman pilots, and seconded Army officers, spend two months at the elementary school. At the end of that time the short-service men are commissioned as Acting Pilot Officers. They then go to Uxbridge for a fortnight to learn how to put on their uniforms, form fours or threes, and get a general idea of discipline. The airman pilots will, of course, have learnt discipline before, but the short-service officers, coming in from civil life, may have very little idea on the subject. From Uxbridge they come to South Cerney or some other F.T.S.

Except for the fact that No. 1 F.T.S. at Netheravon is devoted to teaching naval officers to fly, the ten F.T. schools are all run on the same lines, but as it was South Cerney which *Flight* visited recently we will confine our attention to that school. At one time the Army officers who are seconded to the R.A.F. were all trained at No. 1 F.T.S., but now South Cerney takes some of them. As the Fleet Air Arm is expanding full blast, Netheravon is probably as full as it can be of naval officers and ratings.

The flying training at South Cerney is divided into two parts, while the ground instruction goes on all through the course. The first part is in the charge of the Intermediate Training Squadron, under the Chief Flying Instructor. This is the most critical part of the pilot's course. He has learnt

At the machine gun range. Pilots as well as the rest of an aircraft crew must be able to shoot straight. In many conditions everything will depend on their ability in that direction.

Trying out the synchronising gear on a Hart at the stop-butts. It may be that the days of firing through the arc of the airscrew are numbered, but pupils still have to learn to correct stoppages.

to fly elementary types; he must now learn to fly advanced types such as are used in the Service. All the instructors in the I.T.S. are men from the Central Flying School, all working on the principles formulated and inculcated at that school. They are men who have learnt to analyse what goes on in the mind of the pupil, and to spot why one man may find it difficult to carry out some particular manœuvre. Once the cause is discovered, the remedy may be applied, and often a very simple sort of correction will help a pupil to overcome a difficulty which an inexperienced instructor could never have cured.

There are three flights in the I.T.S., two with twin-engined machines (Oxfords and Ansons) and one with single-engined machines (Harts and Furies), and each pupil is asked what branch of the Service he would like to join. The elementary school always sends up a report on each pupil's tendencies, and this is a guide to the Chief Flying Instructor. It is said that most of the short-service officers, with an eye to future employment in civil air transport, ask for twin-engined bombers or flying boats. Of course, there are always men who love the thrills of throwing a fast machine about, and they probably plump for fighters, while to others the very intellectual work of army co-operation makes a strong appeal. The two latter classes go to the single-engined flight.

Each instructor takes about four or five pupils, but the flight commander supervises all the work in his flight, and the Chief Flying Instructor keeps an eye on all pupils and takes each up with him in turn. He also takes a personal interest in each man, and, as he gains his confidence, finds out why he has applied for a short-service commission. Very often the reason is sheer patriotism. At present there are a number of pupils from the Dominions at South Cerney, and some of them have worked their passages from their own lands to England in order to join the R.A.F. They must be fine fellows, with lots of grit in them. Incidentally, the C.F.I. himself is an Australian in the R.A.F., while the Chief Ground Instructor is an officer of the R.A.A.F. attached on the exchange system.

The intermediate training course takes about fourteen weeks, and at the end of it the pupils who have come through satisfactorily, as most of them do, are thoroughly competent pilots on Harts or Oxfords. They are then given their wings and go off on a fortnight's leave. On return to South Cerney they pass into the Advanced Training Squadron

In the A.T.S. there is no question of teaching the men to fly. That is all over. What they have to learn is how the R.A.F. uses its aircraft in order to make its contribution to the defence of the country in time of war. The two most important things which a war pilot has to do are to find his way to his objective and to destroy the enemy or the enemy's property—in other words, navigation and armament.

Night flying is practised, and, as was stated above, it is hoped soon to go in for more real bad-weather flying. Flying under the hood is one of the ordinary exercises. But when a pilot has found his way to his target, or (if a fighter) has intercepted a raider, his training has been useless unless he can bomb or shoot with accuracy. At South Cerney bomber pilots are practised by using the A.M.L. Teacher and the camera obscura. The A.M.L. Teacher is a darkened room with a gallery round it, on the side of which a bomb sight is fixed. A projector in the roof throws on to the floor below a moving film of a tract of country, which represents what the pilot would see if his aeroplane were moving over that piece of country. The pupil is able to make the film move faster or slower, representing his own changes in speed, and he can swing it round, to represent his own manœuvres in taking aim at the objective which has been given him. The camera obscura is a tent with a lens in the roof and a chart spread out on a table inside, while a metronome ticks out the seconds. Flying over the target, the pilot flashes a light at the moment when he would have released his bombs, and the mathematicians inside the tent, tracing the shadow of the machine on the chart, are able to calculate where the bombs would have fallen. The camera gun gives the pupil his first ideas in hitting another aeroplane with machine-gun fire [*Continued overleaf*

Acting Pilot Officers on the square. Drill is a useful medium for inculcating discipline and smartness

These practices are very useful, but nothing takes the place of dropping live bombs and firing live rounds from the guns. So for four weeks the whole of the Advanced Training Squadron removes itself, complete with instructors and machines, to an armament training station, and there they soothe the nerves of the swaneries, heronries, or other aviaries by dropping live practice bombs on to targets on the sands, and use their machine guns on other ground targets as well as on drogues trailed behind towing machines. That is what makes them really formidable war pilots.

In addition, the Advanced Training Squadron instructs the pilots in formation flying, photography, and, as already mentioned, in night flying. The photographic practice has nothing to do with dark-room work, which is carried out by the station photographic section. The pilot is told to fly off somewhere and take a photograph of some important point, such as a road junction, and it takes some skill and practice to get the right junction on to the plate. He is not passed out until he can be trusted to find the right target. By night he has to prove his ability to land by floodlight and the landing lights on his machine.

Altogether the period in the Advanced Training Squadron takes fourteen weeks. At the end of that time the pilot is passed out as fit for duty with a squadron, and when he gets to his unit he has not much to learn except to fly the particular machine with which it is equipped, and to become familiar with the routine of that squadron in such things as organisation and administration. At South Cerney he has already had some theoretical instruction in the latter.

All through the course at the F.T.S. the pilot gets ground instruction from the Chief Ground Instructor and his staff of lecturers. The syllabus is arranged as follows: To armament there are devoted 45 hours of instruction, to navigation 40, to signals 30, to drill 24, to airmanship 14, to administration and organisation 14, to engines 10, to airframes 8, to maintenance 6, and to reconnaissance and photography 3.

Many Royal Air Force stations are affiliated to some school or schools. South Cerney is a sort of godfather to Cheltenham College and Dean's Close School, Cheltenham, and the boys from these schools visit the station once a term. They are taken all round and shown everything, and are also given flights.

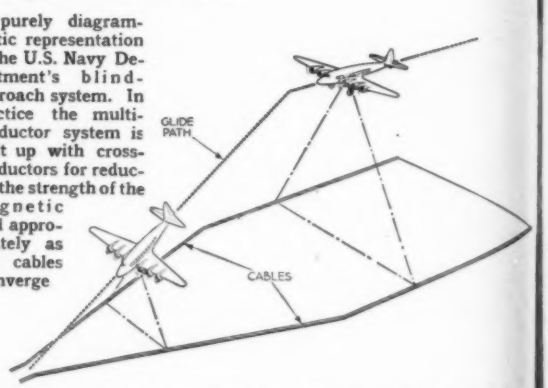
A visit to South Cerney gives the visitor a gratifying impression of thoroughness, of far-sighted planning, and of careful execution. The results are to be seen in the excellent work of the Service squadrons. Though the training of pilots now takes less time than it did before the days of expansion, the results are better. The squadrons cordially admit that the pilots now sent to them from the Flying Training Schools are better trained than they ever were under the old system.

ANOTHER BLIND-APPROACH SYSTEM

RESEMBLING, in some measure, the old Loth cable guide, a new system for blind approach has recently been tested by the United States Navy Department. This system is based on the Ambrose Channel piloting cable, laid in New York Harbour in 1920, wherein two loop aerials on each side of a ship took bearings of an armoured submarine cable laid in the Ambrose Channel. Obviously, an identical system could not be used in the case of aircraft, since, even at 1,000ft., the spacing of the loops could never be great enough to indicate voltage differences.

In the Navy Department's scheme, two cables are used, making a large horizontal loop, and in the machine two loops are mounted with their planes at right-angles, and each lying at 45 deg. to the horizontal. When the machine is in horizontal flight directly above the centre line between the two cables—and at an altitude equal to half the distance between them—each loop receives an optimum signal from one cable and no signal from the other. With a needle operated by each loop, the recording instrument is arranged so that at zero deflection both pointers are vertical, and at full deflection both will be horizontal; at half deflection the two pointers intersect at the centre of the dial. If the machine is flying parallel to the cables, but is above, below, to the right or to the left of the path, each loop receives another value of induced voltage from one cable, and additional voltage from the other—depending on the position of the machine relative to its correct path.

So much for the initial principles. In order to provide a descending path, the strength of the field in the vertical plane midway between the two cables must be reduced. At Lakehurst, where the system is being tested, two multi-conductor cables converge, the landing point being the apex of the triangle. By passing opposite-phase current through cross-conductors in the system, the magnetic field strength is made to diminish in proportion to the convergence of the cables.



A purely diagrammatic representation of the U.S. Navy Department's blind-approach system. In practice the multi-conductor system is built up with cross-conductors for reducing the strength of the magnetic field appropriately as the cables converge

The advantages of this cable system, apart from the fact that it is simple and inexpensive, are that it is impervious to static, can be made to provide a straight or curved glide path, and that the necessary receiving equipment is small and light in weight. Even if batteries are carried, the total weight of the receiving equipment is less than 30lb., and without batteries it is probable the weight can be brought down to a figure in the vicinity of 10lb.

Thirty-five Thousand Words on a Pigeon

SOME interesting details of the "equipment" of the modern carrier pigeon were revealed when H.R.H. The Duchess of Kent released fifty birds during a recent visit to the Fort Dunlop works of the Dunlop Rubber Company, Ltd. The ceremony marked the inauguration of an emergency pigeon post organisation. It will be recollected that the Air Ministry recently made an appeal for assistance from racing pigeon specialists in the formation of a National Pigeon Service.

Each pigeon carries, attached to its leg, an aluminium container holding 25 miniature photographic films, each a little larger than a penny stamp. Written or typed matter on foolscap sheets can rapidly be reduced to this size by a special photographic method. In this way, each bird can carry 35,000 words, and the messages can be instantly read back by means of projection upon a screen. This method, for official purposes, will supersede the existing use of messages on rice paper.

Incidentally, the fifty pigeons referred to above were all birds of pedigree stock which had done 60 m.p.h. in the King's Cup Race—an event just as important to pigeon fanciers as another King's Cup Race is to the aeronautical world.

Training Costs in Africa

DURING the past few years the cost of civil flying training in the various Colonies has been fairly high, since no subsidies have usually been available. In order at least partly to overcome the difficulty, the Aero Club of East Africa nas devised a special subsidy system, the funds for which are obtained partly by a direct grant from the general revenue and partly by special activities. In addition to this the Government has made a direct grant of £300 a year.

Last year the total sum devoted to subsidised flying by the club amounted to £1,500, and during the last two years eighteen pilots have been trained to "A" standard at practically no cost to themselves. First place among the applicants is obviously taken by those young men who comply with Air Force standards in the matter of age and physical fitness.

This year the available subsidy will be used for keeping the already trained pilots in the air, but the unsubsidised charges have, nevertheless, been reduced. These are (for the interest of club members over here): £2 14s. od. per hour solo, and £3 4s. od. for dual instruction. Before the scheme was instituted the respective figures were £3 12s. od. and £4 1s. od.

"SECRETS TRAVEL FAST IN PARIS"

—Napoleon.

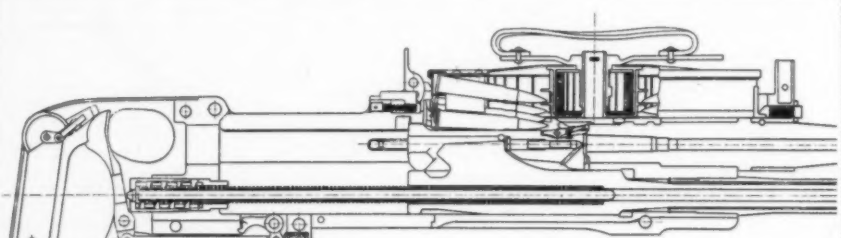
Wellingtons over Paris during the recent "flag-showing" visit of British bomber squadrons to France. Those acquainted with the French capital will recognise the Invalides in this impressive photograph. The picture was secured from another Wellington in the formation, and the "dish-pan" cowling of one of the Pegasus XVIII engines can be seen.

A MODERN AIRCRAFT GUN

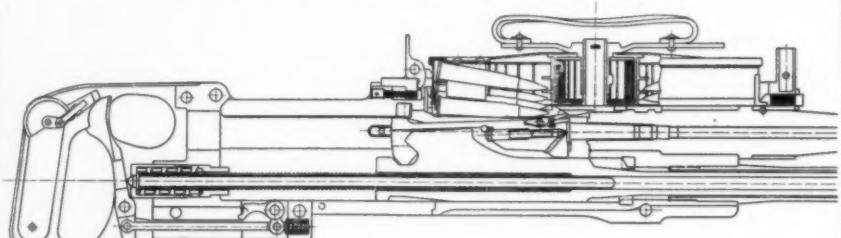
Features of the Vickers K Machine Gun as Supplied to the R.A.F. : Compactness and High Rate of Fire

DESPITE the renaissance of shell-firing armament and the marked trend towards guns of larger calibre, the small-bore, high-speed machine gun still holds pride of place in the aeronautical armoury. Great Britain, more than any other country, has developed installations of multiple machine guns, both fixed and in power-driven turrets. *Flight*, with the co-operation of Flt. Lt. T. Le G. Pynches, of Vickers-Armstrongs, was recently permitted to visit the company's factory at Crayford and to inspect the Vickers Class K machine gun, one of the latest weapons to be adopted by the R.A.F., and probably the most successful gun of its type in the world.

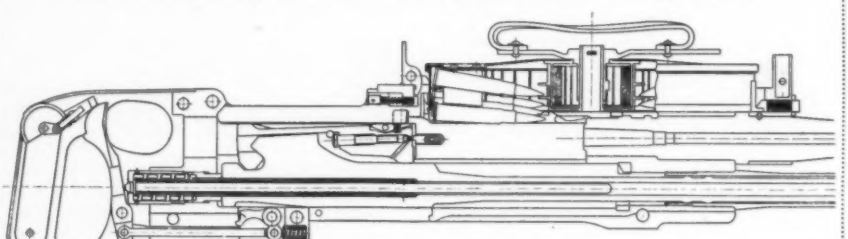
On the top floor of the immense camouflaged main building at Crayford we met Major Kilner, general manager of the Southern Works, who handed us over to Mr. P. R. Higson, the chief designer, and Mr. R. Wanfor, production manager.



Action of the K gun : (1) Piston and breech block have been propelled forward by the tension of the main spring. Breech block is in locked position, and the cartridge has been fired by the piston having pushed forward the firing pin.



(2). Piston and breech block have commenced to move backwards. The rear of the breech block has been brought downwards from engagement with the locking shoulder.



(3) Piston and breech block in their rearmost position. The piston has been brought to rest against the buffer and is about to go forward

The unique features of the Model K were explained by Mr. Higson with the aid of a sectioned gun. This weapon, which has a muzzle velocity of 2,400 ft./sec., is quite exceptionally compact, and has a rate of fire between 950 and 1,200 rounds a minute. The unusually smooth action, combined with a low recoil force, makes the gun easy to control and aim with accuracy. There are no external moving parts which might injure the gunner, and the gun has a minimum of exposed surface. Ammunition is fed from a spring-loaded drum which normally holds 60 or 100 rounds, but which, for fixed installation, can accommodate 300 or 600 rounds in very large, flat magazines. Installed in a fixed-gun fighter, weapons of this sort score over belt-fed models in that the feed arrangements are not affected by "G." The gun may be dismantled in a few seconds with the aid of a cartridge and a pen-knife.

The action can be studied in the accompanying diagrams. When the gun is cocked (by pulling back a handle on the left-hand side), the breech block is retained at the rear of the "receiver," or breech casing, on a projec-

The complete Vickers K gun with ring-and-bead sight. A reflector sight is now fitted. The bag collects the "empties."

tion at the back of a piston. On the trigger being pressed, this piston is propelled forward by the force of the compressed main spring, carrying with it the breech block, which pushes a cartridge from the magazine into the barrel chamber. As the piston continues to move forward, the rear of the breech block is engaged by an angular projection on the rear of the piston, and is forced upwards to abut in front of a locking shoulder on the main body of the gun. Thus, the breech block is positively locked against the base of the cartridge in the barrel chamber. A floating firing pin in the breech block is then struck by a projection on the rear of the piston and the cartridge is fired.

As the bullet is nearing the muzzle a portion of the propelling gases escapes downward through a small hole in the barrel, and is deflected by a gas block to impinge on the head of the piston (housed beneath the rear part of the barrel), driving it to the rear, compressing the main spring, and unlocking and withdrawing the breech block from the barrel.

During the rearward movement of the breech block the empty case is extracted from the barrel and ejected into a bag on the side of the gun. The cycle of operations is repeated until the trigger is released or the ammunition exhausted. A safety catch is incorporated in the handgrip.

Complete with flash eliminator the gun is 40in. long, and, fitted with sights, deflector and bag, weighs 22 lb.

Although normally used as a directly operated free gun the Model K can have remote control for turret or wing mounting, or can be fitted with a stock for ground defence.

Considering the comparatively small section of the main building devoted to K-gun production, the rate of output is highly creditable. Space does not permit a description of the manufacturing processes, though it may be mentioned that there are 140 operations on the "receiver" alone. Mr. Wanfor explained that girls have been found best suited to perform a number of the more delicate operations.

On completion, the guns are sent down an electrical hoist to the proving ground, where two proof rounds are fired. These cartridges have a 25 per cent. more powerful charge than standard ammunition. The guns are then stripped for inspection, reassembled, and are passed out for "automatic" tests in a horizontal position, at 80 deg. elevation and 80 deg. depression. Next they are stripped and cleaned prior to the accuracy trial, which is conducted in the underground range. After a final strip they are inspected both by the company's representatives and the Air Ministry. Thus is reliability in service ensured.

Showing how the K gun can be used from the shoulder. It may also be mounted on a tall tripod for anti-aircraft work.

Opening and Re-opening

A PUBLIC-USE licence has now been issued for the new Oxford aerodrome, which lies about two miles south-east of Woodstock. This aerodrome, which is controlled by the Oxford Corporation, has a maximum run of 1,425 yd. in the S.E.-N.W. direction, and a minimum run of 1,020 yd.

At the same time a private-use licence has been reissued for East Heslerton aerodrome, near Scarborough. Mr. J. R. Micklethwait, who is a director of the Yorkshire Aeroplane Club, is taking a special interest in this aerodrome with the idea, we believe, of starting a new C.A.G. centre there. East Heslerton has been officially out of action during the last year or so.

A few days later a private-use licence was also issued for Swindon aerodrome at Watchfield. This is controlled by Mr. A. J. Walter, who is the agent in this country for the Piper Cub and is operating a Civil Air Guard club there.

Using Reverse

ONE particularly valuable use for reversible-pitch airscrews is not usually considered—that in small-space manœuvring of multi-engined flying-boats. By adjusting the airscrews on one side to reverse pitch, leaving the other two in fine pitch, it would be possible to turn a flying-boat almost within its own length. At the same time, by reversing all four airscrews, rapid deceleration, when necessary, would also be possible.

The Propeller Division of the Curtiss Wright Corporation claims that its electrically operated reversible-pitch airscrew has reached a practical stage in its development, which has been carried out with the co-operation both of the Civil Aeronautics Authority and the United States Navy. Apparently the increase in weight is negligible. The necessary pitch-change is accelerated by the voltage booster unit, which is also used for rapid feathering.

A Sports Major

LUTON AIRCRAFT are at present working on a sports version of the Luton Major. This, it will be remembered, is a cabin tandem-seater strut-braced high-wing monoplane, and the new sports model will be generally similar. The engine fitted, however, will be a Gipsy Minor, giving an additional 30-odd h.p. to that of the Mikron fitted to the standard Major; the undercarriage will be of the cantilever type; and the wing area will be reduced from 35ft. to a little over 30ft.

The dimension figures and loadings will be: Span, 30ft. 2in.; length, 23ft. 9in.; weight empty, 700 lb.; and all-up weight, 1,220 lb. It is estimated that the top speed will be 126 m.p.h.; the cruising speed, 112 m.p.h.; the landing speed, 47 m.p.h.; and the range at cruising speed, 325 miles.

The new Viking, showing wing section (Göttingen 535)—E. J. Furlong (pilot) on far side of nose.

(Above, left) R. C. G. Slazenger, in the Cambridge Club's Kirby Kite, rose 7,200ft. in a storm cloud.

(Left) Instrument panel of the Viking. The thin white upright object is the variometer, or climb-and-fall indicator

CROSS-COUNTRY CUMULUS-CHASING

Perverse Meteorological Conditions for the National Soaring Contests

THE gliding fraternity can often be heard protesting that their sailplanes are not designed to "go places" like the more utilitarian aeroplane. Nevertheless, the marking system at their annual contests is always devised to give a large bonus to people who say where they are going to and succeed in getting there.

At this year's Contests, held from July 8 to 16 at Great Hucklow, in Derbyshire, the bonus was given only for cross-wind flights. It was worked out according to an ingenious formula which took account of the distance flown, deviation of the course from the wind direction, and speed of the wind. But, as before, the pilot had to reach a previously announced goal in order to earn it, and unfortunately, although much good cross-wind flying was done, no competitor ever attained his goal. On the few occasions when a pilot found it within reach, the going was so good that he went far beyond it and earned more marks that way.

Meteorologically, the contests might have been divided into two periods: one of strong west winds with instability up to not more than 5,000 feet, followed by one of weak southerly winds with thundery showers, caused by the air being unstable up to great heights.

During the westerly weather it was usual for the sky over the Derbyshire hills to be nearly overcast, with rather ragged clouds that provided little, if any, lift, while out on the plains beyond the most glorious cumulus was waiting to be used. The result was a sharp division between those pilots who reached the good stuff and went on and on, and those who were let down after their first thermal and had to land among the moors a few miles to leeward.

Monday, July 10, and Wednesday, July 12, were the outstanding days for cross-country flying. On Monday the two longest distances were flown: 162 miles to Southend by Christopher Nicholson in the Rhönsperber, and 103 miles to Shouldham, near King's Lynn, by Philip Wills in his Minimoa. Both pilots had a struggle to get away from the hills under an almost overcast sky. Mr. Wills, when his first thermal had let him down about ten miles from the start, was reduced to doing figures-of-8 over a 60-foot slope just outside Chesterfield, and only came unstuck again when there were signs of a thermal going up from some blast furnaces a few hundred yards to leeward. Further on there was real text-book cumulus, and all went well until finally the damp land around The Wash refused to provide him with lift.

Mr. Nicholson managed to keep well inland by cross-wind flying, and just hopped from cumulus to cumulus across East Anglia. All the clouds were in excellent working order, and there was no need to do more than ten minutes' blind flying in any one of the fifteen which he encountered. They only melted away as Mr. Nicholson neared Southend, which he reached at 7 p.m. with 1,000 feet of height to spare

On this day Mr. W. E. Filmer made a cross-country flight which, though only 12 miles in length, was remarkable for the meteorological conditions which enabled it to be done. Throughout the day everyone had noticed a huge roller of cloud which sat above Kinder Scout, nine miles up-wind, and never came any nearer. Mr. Filmer watched it closely, found that its visible, or leeward, side was perpetually cascading downwards, decided that the cloud represented the crest of a stationary wave of air, and set out in his Viking sailplane to investigate. At 2,750 feet, and two miles up-wind from the launch, he found himself in a sort of trough between two enormous waves of cloud; one was the cloud he had been watching, and the other had its crest above the competition site. He plunged into the second cloud and found, as he expected, that it was the upward rebound from the first, for the Viking rose at 3 feet per second inside it. But Mr. Filmer soon lost his bearings, and came out through the bottom of his cloud on the downward side of the wave, falling at 5 ft./sec. He failed to reach a third 'roller."

The Viking, a new British high-performance type, appeared for the first time at a National Contest. It was produced by Scott Light Aircraft, of Dunstable, late last year. Another new British sailplane, also appearing for the first time, was the Petrel, designed and built by Slingsby Sailplanes.

Squadron Leader P. M. Watt, who was given a Petrel to fly, showed off its paces to good effect on Wednesday, July 12, when it shared with Mr. G. H. Stephenson's cross-channel Kirby Gull the honour of making the longest flight of the day. Both landed at Skegness aerodrome, 86 miles from the start. The Petrel is not so fast as the King Kite which Sqn. Ldr. Watt flew last year; nevertheless its speed range is such that he could maintain an average course at 45 degrees to the wind direction. This took him south-east to Nottingham, which, he said, gave him a marvellous thermal. From there he went down wind to Boston, where he found a sea breeze undercutting the westerly land wind and producing a continuous belt of lift. He was thus able to fly up the coast for 20 miles.

Altitude Aspirants

By Friday, July 14, the more venturesome pilots were looking to altitude flights in instability showers.

Mr. R. C. G. Slazenger disappeared into the dark base of one of these storm clouds immediately after being winched up to 900 feet above the hill top. He was not seen again till after he had climbed 7,200 feet through the cloud in 20 minutes, spent half an hour trying to get higher in it and a further half hour trying to escape into clear air, come down again equally rapidly, and, owing to frost on his spectacles obscuring his vision, hit a stone wall on landing 35 miles away.

This was one of the only three crashes of any consequence, and it is the more regrettable that the other two should have led to fatal results. On July 11 Mr. W. E. Godson got into a spin in his home-made Kestrel and hit the ground at a steep angle; he died four hours later from his injuries. And on July 15 an extraordinary sequence of events led to Mr. Frank Charles, the well-known speedway rider, failing to release the cable after a launch; his Petrel was pulled vertically into the ground from 100 feet and he was killed immediately.

Of the numerous events for which prizes and trophies were awarded, the chief was the Open Contest, decided on points. It was won by the Rhönsperber, flown by C. Nicholson and F. T. Gardiner, with 595 points. P. A. Will's Minimoa came next with 573 points, and the Gull, flown by G. H. Stephenson, D. F. Greig and J. C. Dent, third with 329 points. The Cambridge University Club's Kirby Kite, with 327.4 points, was also the winner of two events confined to club entries.

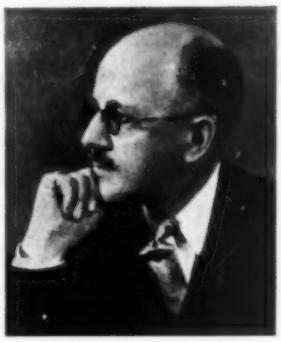
Altogether, during the contests, over 400 hours of soaring were done, and 58 cross-country flights were made, covering an aggregate distance of 1,835 miles. A. E. S.

FROM EAGLE to MERLIN

The Story of Rolls-Royce Aero Engines During a Quarter-century

NOW that liquid-cooled engines for aircraft are finding increasing favour throughout the world (our own designers, be it said, have never lacked appreciation of their qualities) it is fitting that a survey should be made of the development of the outstandingly successful units of this type made since 1914 by the Rolls-Royce Company.

This survey is intended as an outline of Rolls-Royce engine development; the romance of the company itself has been ably dealt with by Mr. Harold Nockolds in his book *The Magic of a Name*, from which we are constrained to quote, as an illustration of the esteem—we almost said "reverence"—in which "R.-R." products are held, the story of the Rolls-Royce car owner who took his ancient "20" to the Rolls service depot for an overdue decarbonisation. During a short drive to test the condition of the engine the tester remarked, "Ah, sir, now she's detonating." Being unversed in automobile engineering, the owner enquired the meaning of the word detonation, and was told, with solemn dignity, "Well, sir, in *other* cars it's known as pinking."



Mr. A. F. Sidgreaves, managing director of Rolls-Royce, Ltd.

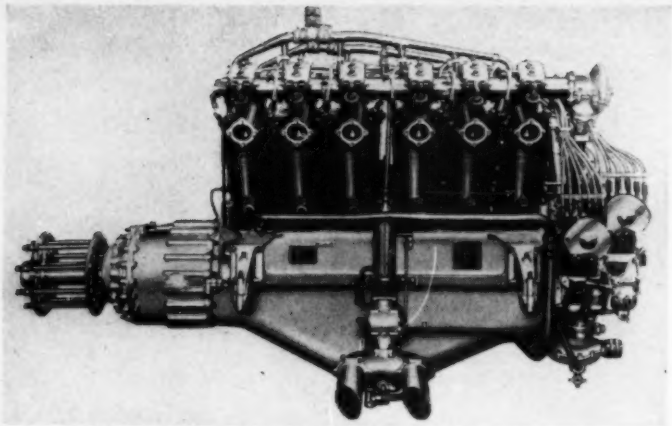
The company had very memorable aeronautical associations ever since its inception, though the manufacture of aircraft engines did not commence until 1914. The late Hon. C. S. Rolls, one of the founders of Rolls-Royce, Ltd., was among the earliest British pilots, and made the first double crossing of the Channel on June 2, 1910, flying a Wright biplane. He was killed at the Bournemouth flying meeting shortly afterwards.

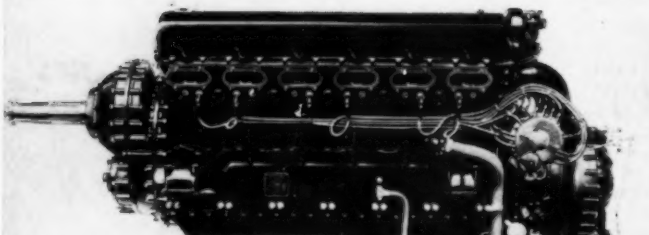
Flying as such never appealed to Mr. (later Sir) Frederick Henry Royce, chief engineer of Rolls-Royce, Ltd. He was continually being urged by the Hon. C. S. Rolls to develop aero engines, but he remained antipathetic until he realised how dire was the need of his country in 1914, when officials of the Admiralty visited him with a view to obtaining his services in the design and production of aircraft engines. On August 4, 1914, all deliveries of new Rolls-Royce cars to private customers ceased, and the works were turned over to production of French Renaults and engines designed at the Royal Aircraft factory. Aided by Mr. Elliot, his chief assistant, Sir Frederick set about designing the first Rolls-Royce aero engine. As he was embarking on an entirely new project there was close co-operation with the works, and a vast amount of correspondence between Royce and Claude Johnson at the factory at Derby, who passed on instructions to Mr. Hives in the experimental department.

Claude Johnson saw in these letters more than technical business correspondence; he realised that they epitomised Royce's whole doctrine of engineering. When the engine was finished they were published chronologically in a book which subsequently became known as "the Rolls-Royce Bible." It is said that, bound in dark blue leather and marked "strictly private and confidential," it is one of the most secret and instructive engineering documents in the world. Only a dozen copies were printed, and the heads of the designing and engineering staff to whom they were handed had orders always to keep them under lock and key.

Out of this vast correspondence and unremitting work came the first Eagle engine, which was started up on the test bed at Derby one day in October, 1915. It was expected to deliver 200 h.p., but the record-

Three outstanding Rolls-Royce installations: below, the faithful Falcon in the Bristol Fighter; upper right, the shapely Hawker Hart, with its Kestrel, and, lower right, the Boulton Paul Defiant of to-day, showing the beautifully cowled Merlin.





Reading from top to bottom on the left, these Rolls-Royce "milestones" are the Eagle IX, the Condor IIIB, Kestrel IIS, Buzzard, and the "R" type racing engine developed for the Schneider Trophy Supermarines. It will be noted that the Kestrel is the first unit with monobloc castings for the cylinders.

ing needle swept on past the 200 mark until the engine was delivering 255 h.p. at 1,800 r.p.m.

By March, 1916, the Eagle was delivering 266 h.p. at the same speed of revolution. Another four months saw a further increase of 18 h.p. By December in the same year the power had risen to 322 h.p. In September, 1917, the engine was given a rating of 350 h.p. And by February, 1918, no less than 360 h.p. was being taken from a unit which was originally designed for only 200 h.p.

Government orders flowed in, and the Derby works, despite rapid expansion, were found inadequate. So Rolls-Royce technicians were sent to America to make arrangements for producing 1,500 Eagles. While in America they gave designers the benefit of their knowledge to perfect the Liberty engine, employed in vast numbers toward the end of the war.

From the very first the Rolls-Royce Company appreciated the advantages of water as a cooling medium, claiming that it ensured equalised temperature throughout the cylinder and provided heat-dissipating surfaces in a form offering very low air resistance.

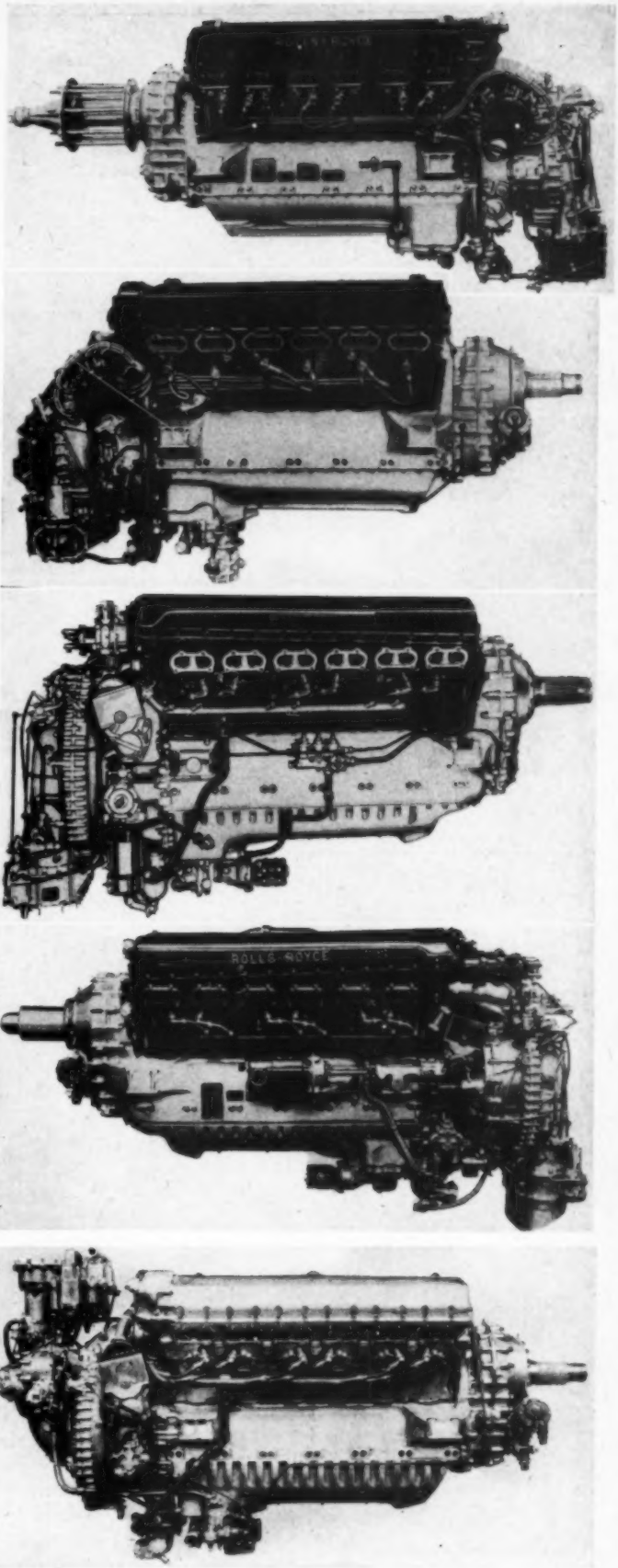
At first the Eagle 60-deg. vee-twelve, with its forced lubrication and four carburettors, was regarded by many as being complicated. Nevertheless, it will go down in history as an outstandingly successful type, and the basis for Rolls-Royce liquid-cooled practice up to the present day.

Appreciation from the Enemy

The best known of all the Eagles was the Mark VIII, which gave 355 h.p. at 1,800 r.p.m. (normal) for a dry weight of 925 lb. Of this engine it was said by a German authority who inspected an example captured during the war, "One of most interesting of hostile aero engines, on the highest plane in respect of design, is undoubtedly the Rolls-Royce."

The Eagle was followed in 1915 by two smaller engines, known respectively as the Hawk and Falcon, the former having six cylinders and the latter twelve of similar bore and stroke (4in. × 5.75in.). The Hawk was intended primarily as an airship engine, and was originally rated at 75 h.p., though by the end of the war it was yielding 105 h.p. The Falcon was intended, in the first place, for the famous Bristol Fighter biplane. Originally designed for 228 h.p., the Falcon was subsequently given ratings at 247 h.p., 262, 278, and eventually 285 h.p. As the Falcon III it weighed 725 lb. and gave a normal output of 280 h.p. at 2,000 r.p.m. (the maximum was 2,200) with a compression ratio of 5.3 to 1. Like the Eagle, it was a geared type, the ratio being 0.59: 1. Eagles and Falcons were installed in a wide variety of military types. The great Porte biplane flying boat, for instance, was fitted with no fewer than five Eagles, giving a total output of 1,750 h.p. Eagles were also installed in the "North Sea" non-rigid airships, while the little Hawks were unostentatiously humming away in "Blimps."

Toward the end of the war the first Condor appeared in a modified form. This type remained in service with the R.A.F. until a few years ago. The early model of the Condor ran



On the right, reading down, are the Kestrel XVI, Kestrel XXX, Merlin I, Merlin X and Peregrine. The Merlin X has a two-speed supercharger denoted by the length of the rear portion of the engine.

at a normal speed of 1,750 r.p.m. and delivered 600 h.p., consuming 39 gallons of fuel an hour. The weight, with 0.666 reduction gear ratio, was 1,300 lb.

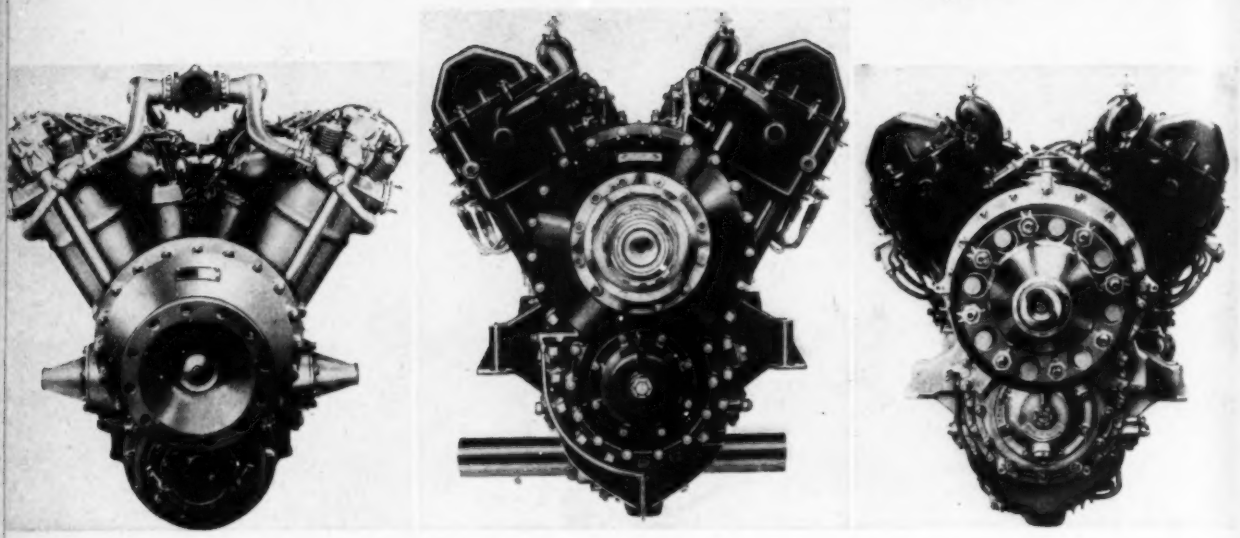
Shortly after the war, in 1919, Rolls-Royce engines, installed in a Vickers Vimy biplane flown by Sir John Alcock and Sir Arthur Whitten-Brown, made the first direct air crossing of the Atlantic, flying from Newfoundland to Clifden, Co. Galway. This flight demonstrated, among other things, the potentialities of water-cooled engines for use in commercial aircraft, though the great majority of Rolls-Royce engines have been installed in military machines.

Condor development proceeded apace. The original Series I engine (which, incidentally, differed from the Falcons and Eagles in that it had four instead of two valves per cylinder) was succeeded by the Condor IA, which gave 650 h.p., and ran at 1,900 r.p.m. The Series III Condor was further modified, and gave approximately the same power, but weighed nearly 300 lb. less (1,154 lb.). Features included an aluminium alloy crankcase split horizontally along the crankshaft centre line, a revised type of single-spur reduction gear, and a special twin carburettor of Claudel-Hobson design built by the Rolls-Royce Company. Condors were installed in a variety of military aircraft.

A *Special Condor*

A special version of the Condor was developed for installation in fighters and other high-speed aircraft. This was generally similar to the Condor III, but was a direct-drive unit and was designated the Condor IV. It was developed because it was found that reduction gear gave a rate of revolution too low to permit the use of the most efficient airscrew. Apart from the omission of the reduction gear, the crankcase was fitted with cast feet for the engine bearers instead of ball-joint front-end mounting, and the spring link rear mounting previously standardised. The engine gave a normal output of 650 h.p. at 1,900 r.p.m., and weighed 1,250 lb.

In many essentials the Condors resembled the original Eagles and Falcons, but in 1927 there appeared an engine which broke away quite drastically from previous practice. This was originally known as the F.X, and was the forerunner of the Kestrel series. The F.X was a twelve-cylinder unit of 5in. bore and 5½in. stroke. At first no reduction gear or supercharger was fitted, but these were subsequently added. A notable innovation was the forming of each block of six cylinders from one aluminium alloy casting with inserted steel barrels in direct contact with the cooling water. Cylinder heads and gas passages were formed integrally with the cylinder castings. The cylinder blocks were secured to the crankcase by long studs passing down the cylinder casting and abutting on the crankcase by means of flanges formed on the cylinder liners. A single overhead camshaft carried on each cylinder block operated the valves, the mechanism being lubricated by low-pressure oil and completely enclosed. Data were: Normal h.p., 460 at 2,100 r.p.m.; maximum h.p., 490 at 2,350 r.p.m.; fuel consumption at normal power, 30 gal./hour; and weight, 760 lb.

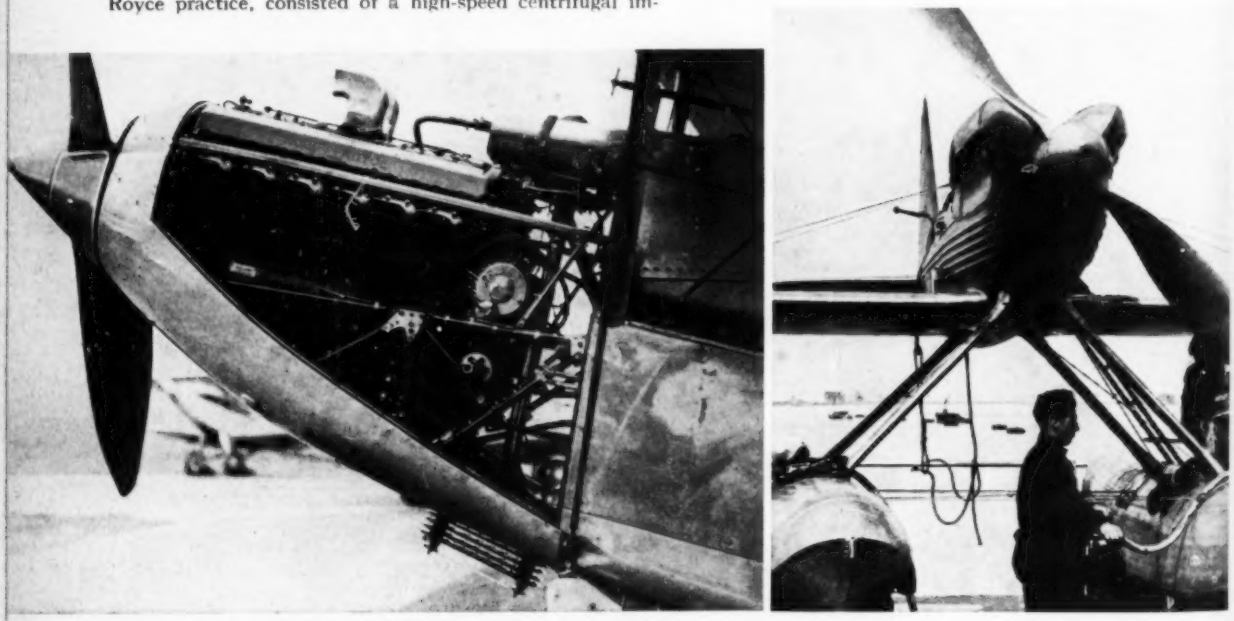


Low frontal area has always characterised Rolls-Royce engines. From left to right are the Condor IIIA, the Buzzard and Kestrel XVI.

At the Aero Exhibition at Olympia in 1929 the engine appeared in a developed form. The F Series was then available in four models—the F-XIA, F-XIB, F-XIIA and F-XIIB, these units differing only in reduction gear ratio and compression ratio, the letters A and B indicating ratios of 6 to 1 and 7 to 1 respectively. With the lower compression ratio the "F" engines developed 490 h.p. normal at ground level, and with the 7 to 1 ratio, 480 h.p., maintaining this output up to 3,000ft. A fully supercharged unit was also introduced for maintaining ground level rated power up to 11,500ft.

A contemporary engine of larger size and much higher output was the "H," which eventually became known as the Buzzard This was generally similar to the Kestrel in construction, and embodied the same type of supercharger, driven together with the timing gears and auxiliaries from the crankshaft through the medium of a torsionally flexible shaft acting as a spring drive. The supercharger, which formed the basis of present-day Rolls-Royce practice, consisted of a high-speed centrifugal impeller of aluminium alloy driven at 5.5 to 1 times the engine speed in the moderately supercharged engine and 10 to 1 in the fully supercharged units. The rate of revolution in the latter engines was about 22,500 r.p.m. Weighing 1,460 lb., the Buzzard gave a normal output of 825 h.p. at 2,000 r.p.m.

For Schneider Trophy racing purposes a special engine was developed from the Buzzard, first appearing in the Supermarine S-6 seaplane which won the Trophy in 1929. Though using the majority of the standard moving parts, the "R" engine, as this really astonishing new unit was known, was externally very different from its prototype. The majority of the exterior modifications were made to improve streamlining, and included fairing the valve covers, giving a different external finish to the cylinder blocks, modifying the bottom cover and altering the bearer feet in order to decrease the overall width of the engine at the front. Modifications to the auxiliary gears reduced the



The familiar installation of the Kestrel in the Hawker Hart (left) and its variant types is known to thousands. On the right is something rather more special—the Rolls-Royce "R" engine installed in the Supermarine S.6 racing seaplane.

overall depth, and the length of the nose section was increased to allow better cowling. A reduction gear of 6 to 1 ratio was fitted to suit the high forward speed of the S.6.

In order to give a very high power at ground level the supercharger was of entirely different design from that used on the "H." Dimensions were increased and the casing strengthened against backfires. Naturally, special racing fuel was employed.

It was some while before figures for the "R" type engine were released, but it was eventually disclosed that the 1929 engine gave 1,900 h.p. at 2,900 r.p.m., and weighed 1,530 lb. By 1931 the engine had been developed to give 2,300 h.p. at 3,200 r.p.m. for a weight of 1,630 lb., so that a power increase of 21 per cent was obtained for a rise in weight of 6½ per cent. Improvements made in the later engine included an alteration in the supercharger gear ratio and the size of the air intake and a rise in engine speed.

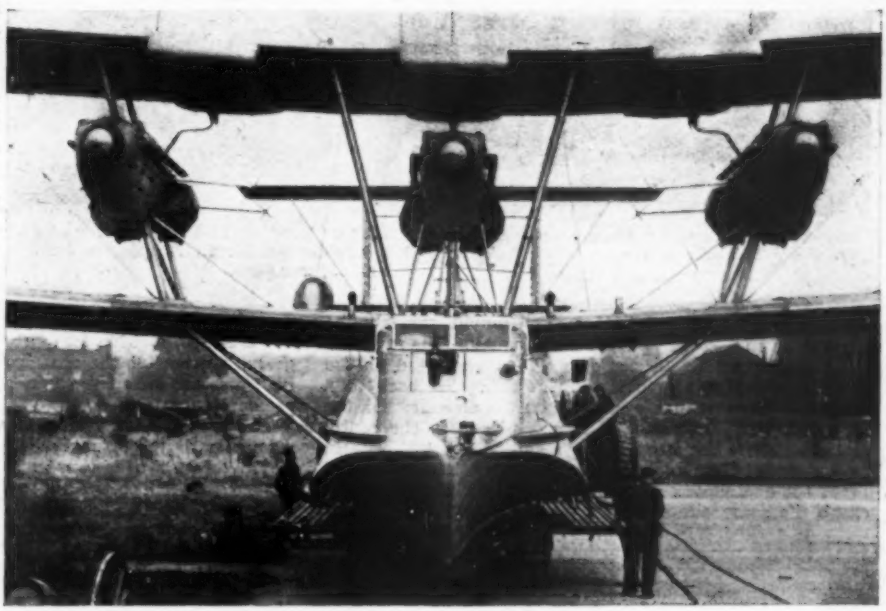
The earlier engine was fitted in the Supermarine S.6, which, in 1929, piloted by Flying Officer H. R. D. Waghorn, won the Schneider Trophy at a speed of 328.63 m.p.h. In 1931 the improved engine was fitted in the S.6B, which, with Flt. Lt. J. N. Boothman as pilot, won the race at 340.08 m.p.h. A similar machine was used on the same day by Flt. Lt. G. H. Stainforth to establish a new world's speed record of 378.05 m.p.h. Later, with a special "sprint" engine giving 2,600 h.p., Stainforth raised the figure to 407.5 m.p.h.

At about this time the Royal Aircraft Establishment was experimenting with a version of the Condor running on heavy oil. In its compression-ignition form the Condor developed about 500 h.p., the weight being 1,400 lb. There was one pump in the head of each cylinder, mounted at a slight angle and operating on the "jerk" principle. Adaptations of the standard Condor, using petrol, were fitted in the airship R.100.

The standard Kestrel range was developed, re-rated, and the engines given the series numbers I, II, or III, according to reduction gear ratio, followed by the letters B, MS, or S, denoting whether the unit was of the high-compression type, moderately supercharged, or fully supercharged. The B type developed 525 h.p. up to 3,000ft.; the MS gave 525 h.p. at sea level and 500 h.p. at 3,000ft., and the "S" type 525 h.p. at 11,500ft. It was these engines more than any others which put British fighters and bombers ahead of everything else in their class. In Furies, Fireflies, Harts and Foxes flown by pilots like Bulman and Staniland, they were frequently used with "doped" fuel for demonstration purposes, and put up some astonishing performances.

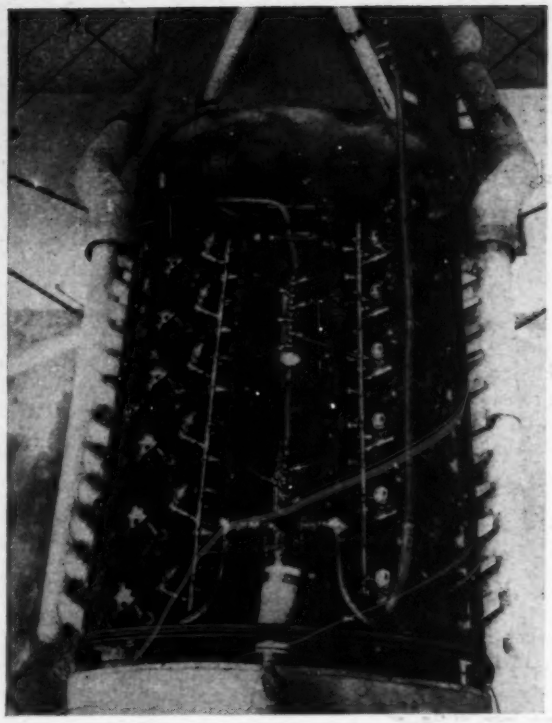
With the introduction of the D.T.D. 230 fuel (87 octane) the Kestrel was again re-rated and modified to give considerably increased output. The fully supercharged engines (IV, V and VI) gave a maximum power of 640 h.p. at 2,900 r.p.m. at 14,000ft.; the medium supercharged versions (VII, VIII and IX) were raised to 730 h.p. at 5,000ft.; and the supercharged models (X, XI and XII) gave 625 h.p. at sea level with a compression ratio of 7 to 1.

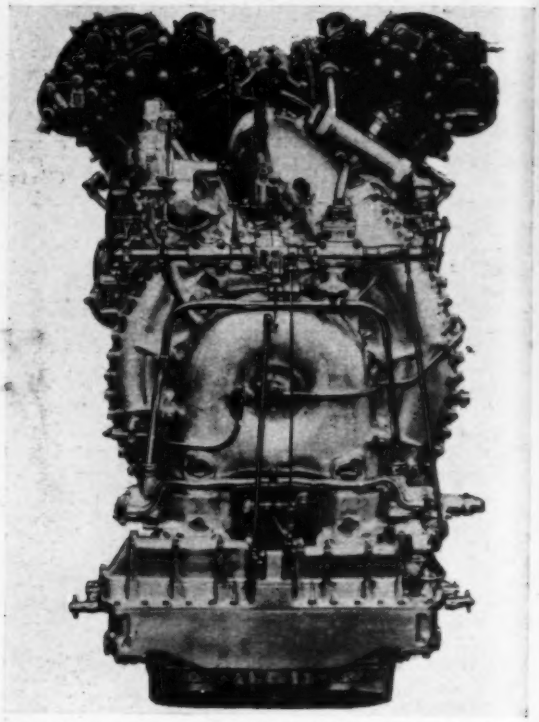
Engines of the new series were type-tested for composite cooling, which meant that they were partially water-cooled and partially steam-cooled. Composite cooling



"Flight" photographs.

The unusual installation of the Kestrels in the Fairey Hendon bomber (top) featured radiators in front of the "trousers" and a peculiar exhaust system, forerunner of the "ramshorn" type. Below the Hendon is the Blackburn Perth (3 Buzzards) with side radiators on the nacelles. Finally comes a comparatively modern Merlin installation in the Hawker Henley.





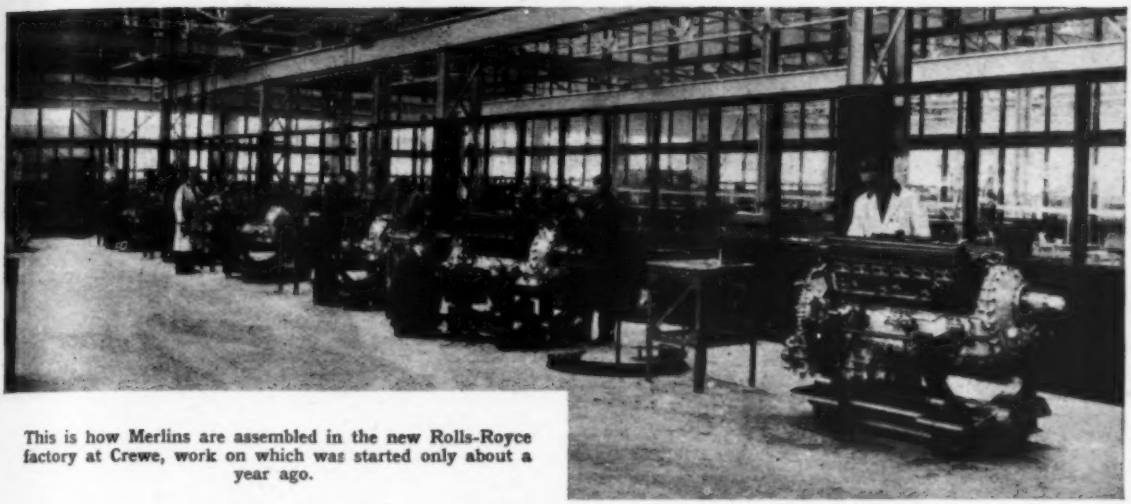
The compression-ignition Condor was test-flown in a Hawker Horsley which type was normally fitted with the standard Condor. On the right is the rear view of the new two-speed supercharged Merlin X specified for a number of high-performance military machines.

allowed the use of a radiator which would normally be used for an engine of 25 per cent. less power. The radiator, being inadequate to dispose of the heat generated on the climb, allowed steam to form, this being led back to a condenser in any suitable position on the aircraft. On the Hawker Hind, for example, it was placed in the centre section. There the steam was condensed and taken back, as water, into the main cooling system. Thus, in level flight the engine was entirely water-cooled, though on the climb the composite system came into action.

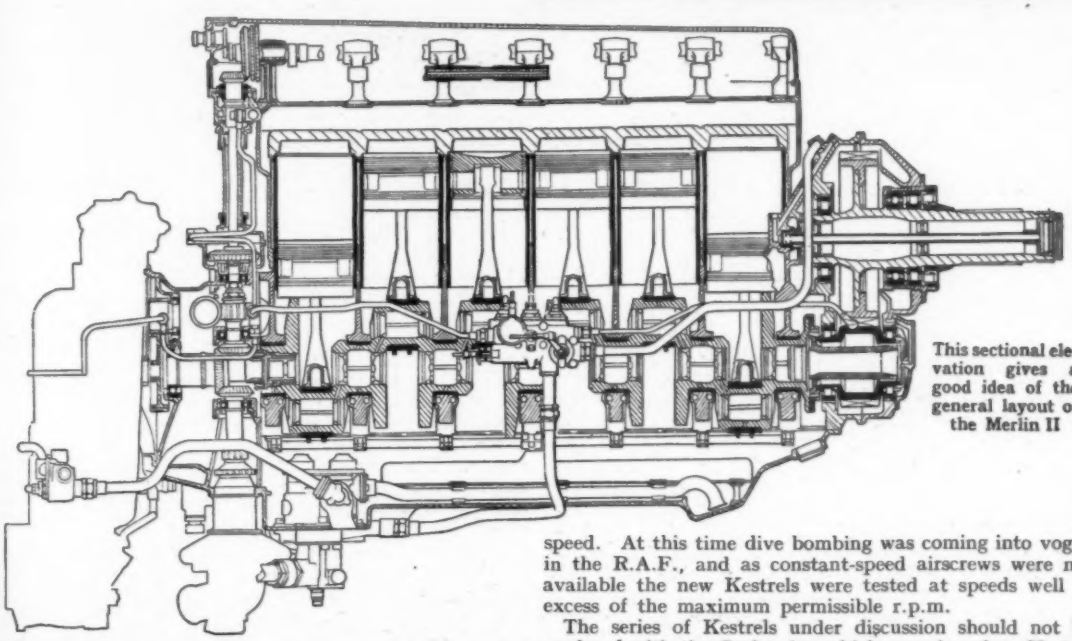
By this time the demand for accessories had become very heavy, and the new Kestrels incorporated, among other things, a drive for operating two gun synchronising gears, a drive for the electrical generator, provision for a high-pressure air compressor, and another drive for a low-pressure compressor.

The modifications made to give higher output included a heavier degree of supercharging in conjunction with an improved form of blower in which the carburetter was re-designed to reduce the air entry losses; refinements in the cylinder blocks to increase the reliability of the cylinder top joint rings; and the running of the engine at a higher

The Rolls-Royce experimental section at Hucknall used the Hawker Fury on the left for experiments with cooling systems. On the right is a Merlin installed in an Armstrong Whitworth-Whitley IV bomber. This aircraft is a standard type in the R.A.F.



This is how Merlins are assembled in the new Rolls-Royce factory at Crewe, work on which was started only about a year ago.



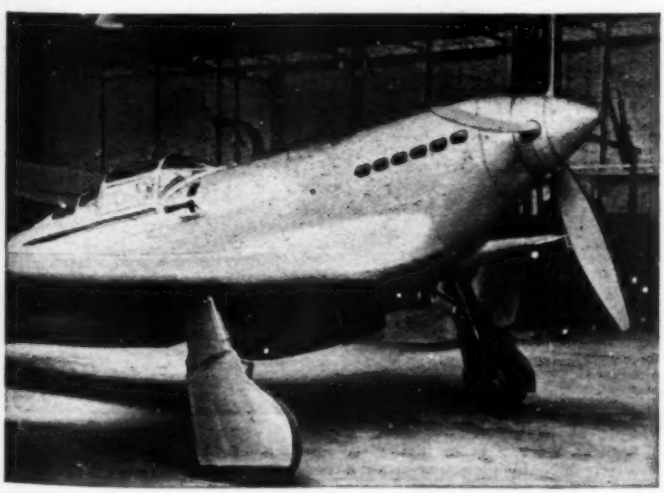
This sectional elevation gives a good idea of the general layout of the Merlin II

speed. At this time dive bombing was coming into vogue in the R.A.F., and as constant-speed airscrews were not available the new Kestrels were tested at speeds well in excess of the maximum permissible r.p.m.

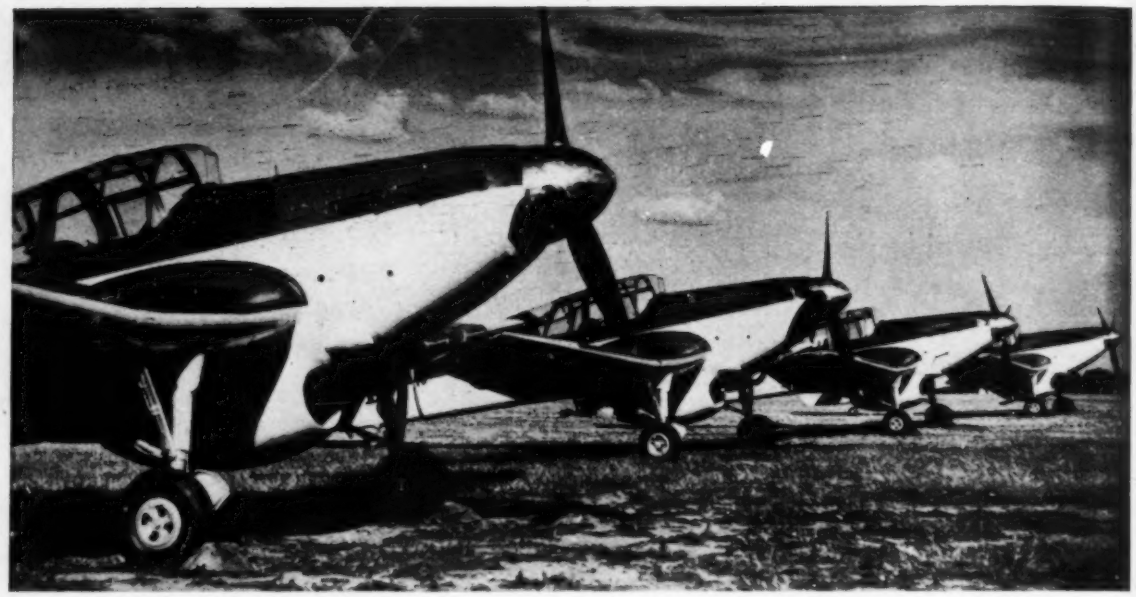
The series of Kestrels under discussion should not be confused with the Goshawks, which were based on Kestrel practice, were all steam-cooled, and embodied a number of other modifications, though their power outputs were generally similar to those of the Kestrels. Goshawks were installed in a number of experimental fighters to the F.5/34 specification and in the Short "Knuckleduster" flying boat.

Experiments with steam-cooling had been made some years earlier, notably with a Fairey Fox biplane with an F type engine. This system, however, was proved unsuitable for Service use, and development was suspended.

The advent of variable-pitch airscrews further increased the power which could be taken from the new series of Kestrels. For example, the Kestrel XVI (v.p.) had an international rating of 715 h.p. at 2,750 r.p.m. at 12,250ft., the corresponding figure for the ver-



The complete installation of the Merlin III in the new Belgian Renard R. 38 fighter (left) is of Rolls-Royce design. Belgium is but one of the countries which has standardised on Rolls-Royce engines over a period of years.



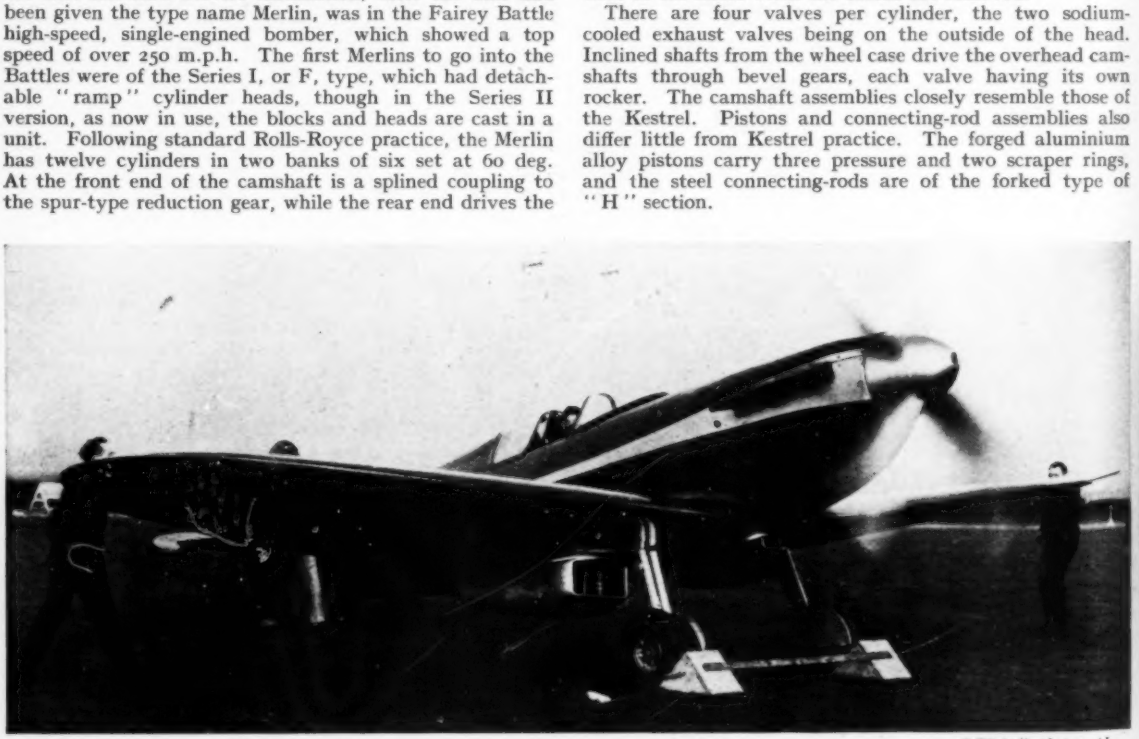
Miles Master advanced-training monoplanes with Rolls-Royce Kestrel XXX engines. The Kestrel XXX has been specially developed to meet training requirements. A description of the Master appears in this issue.

sion with fixed-pitch air-screw being 690 h.p. at 2,600 r.p.m. at 11,000ft. The take-off power was likewise increased from 670 h.p. at 2,225 r.p.m. to 745 h.p. at 2,750 r.p.m., both figures being at 6 lb. boost.

During 1935 rumours began to circulate that the Rolls-Royce Company had produced an entirely new type of engine giving about 1,000 h.p. The first engine of this type was installed experimentally in a Hawker biplane, though the first standard Service installation, after the unit had been given the type name Merlin, was in the Fairey Battle high-speed, single-engined bomber, which showed a top speed of over 250 m.p.h. The first Merlins to go into the Battles were of the Series I, or F, type, which had detachable "ramp" cylinder heads, though in the Series II version, as now in use, the blocks and heads are cast in a unit. Following standard Rolls-Royce practice, the Merlin has twelve cylinders in two banks of six set at 60 deg. At the front end of the camshaft is a splined coupling to the spur-type reduction gear, while the rear end drives the supercharger, camshaft and auxiliaries through a spring-drive unit.

As in the Kestrel series, the modern Merlin cylinder block is an aluminium casting fitted with "wet" steel liners. Fourteen long studs, the reaction of which is entirely upon the liners, secure each of the blocks. An additional six studs on each side of the blocks (as first tried on the Kestrel XVI) improve the face joints and prevent disturbance of the liners when the blocks are removed.

There are four valves per cylinder, the two sodium-cooled exhaust valves being on the outside of the head. Inclined shafts from the wheel case drive the overhead camshafts through bevel gears, each valve having its own rocker. The camshaft assemblies closely resemble those of the Kestrel. Pistons and connecting-rod assemblies also differ little from Kestrel practice. The forged aluminium alloy pistons carry three pressure and two scraper rings, and the steel connecting-rods are of the forked type of "H" section.



"Flight" photograph.

The special Supermarine Spitfire (Rolls-Royce Merlin) used by the R.A.F. for high-speed research. Only a limited amount of information is available on this aircraft, but it is believed that since this picture was taken the cooling system has been improved.

Boost pressure is controlled by an automatic servo device working through a differential linkage to limit the throttle opening and to protect the engine from any damage resulting from overboosting. In this respect the Merlin differs from the Kestrel, in that the boost control is of the progressive type with the boost pressure determined by the degree of throttle opening and maintained automatically within a range determined by altitude, the range increasing with throttle opening. The boost pressure is not maintained over the whole throttle range until rated boost is reached.

More and more accessories are being demanded by designers, so the Merlin is equipped to accommodate an engine-driven electrical generator, low-pressure and high-pressure air compressor, a Lockheed undercarriage pump, a gun turret pump, a constant-speed unit for the airscrew, and a vacuum pump for operating the blind-flying panel, automatic pilot or de-icers.

The standard Merlin II (the Merlin III and IV are generally similar) is rated at 990 h.p. at 2,600 r.p.m. at 12,250ft., the maximum power being 1,030 h.p. at 16,250ft., though if a properly designed air intake is used the full speed of the aircraft is developed at a considerably greater altitude. This, for a standard Service-type liquid-cooled engine (many hundreds are in use) weighing 1,335 lb. dry must be considered outstanding.

In keeping with modern requirements, the Rolls-Royce Company have developed a two-speed supercharger to improve the take-off and low-altitude performance during climb or level flight and fuel economy under cruising conditions. The speed change is effected through an oil-pressure system, the actual change-over under full power conditions taking about one second. The two-speed supercharged engine of the Merlin series is known as the Merlin X; in low gear this unit gives no less than 1,145 h.p. at 5,250ft., and 1,025 h.p. at 17,750ft., the take-off power being 1,065 h.p. Weight is little more than that of the Merlin II.

At the last Paris Show figures were displayed on the Rolls-Royce stand for an even more startling development. These related to the Merlin RM 2M as rated on 100-octane fuel. At 7,870ft. the output is 1,265 h.p., while at 9,500ft. the figure is 1,285 h.p. For take-off 1,320 h.p. is available. The incorporation of a two-speed blower on a similar engine permits a maximum output of 1,160 h.p. at 16,730ft.

Another innovation at the Paris Show was the Rolls-Royce Peregrine engine. This is extremely compact, and, although of Kestrel capacity (21.3 litres), has an international rated power of 830/860 h.p. at 13,500ft. in its Mark I and Mark II forms. External differences from the Kestrel include the downdraught carburetter. Obviously the Peregrine would be admirably suited for installation in a twin-engined fighter.

The latest engine to be announced by Rolls-Royce is actually a comparatively low-powered type and is, in fact, a development of an earlier unit. This is the Kestrel XXX, which has been specially developed for training purposes and is standard equipment in the Miles Master described in this issue. Compared with the Kestrel V, the engine is de-rated for climbing and level flight, providing a longer life between overhauls.

The story of Rolls-Royce goes on. The latest page was written but a few days ago, on July 14, when Sir Kingsley Wood, Secretary of State for Air, visited the magnificent new factory at Crewe. Sir Kingsley put the price at about £1½ million and paid a tribute to the celerity with which the Rolls-Royce Company had got the factory going, for on July 6 last year the first turf was cut. Sir Kingsley referred to the new and even larger Rolls-Royce factory in Glasgow, and in a toast to the new works coupled the names of Lord Herbert Scott (chairman) and Mr. E. W. Hives (works manager). Mr. A. F. Sidgreaves, managing director, said that his firm had already spent £700,000 on expansion, had put £250,000 into Rotol Airscrews, Ltd., and £150,000 into Phillips and Powis Aircraft, Ltd.

Foreign competitors, who are not bound by such stringent official regulations, have announced engines of 1,700-2,000 h.p. We may be sure that Rolls-Royce are not lagging behind in development.

SOME ROLLS-ROYCE SUCCESSES

THE name of Rolls-Royce is founded not so much upon a string of record achievements as on excellence of service in everyday use. However, the following is a list of a few of the better-known performances achieved with Rolls-Royce engines:—

First Direct Transatlantic Crossing, June 14-15, 1919.—Capt. J. Alcock and Lt. A. Whitten-Brown on a Vickers Vimy with two Rolls-Royce Eagle engines. Distance, 1,950 miles. Time, 16 hr. 12 min.

England-Australia, November 12-*December* 10, 1920.—Sir Ross Smith and Sir Keith Smith in a Vickers Vimy with Rolls-Royce Eagle engines. Total distance, 11,130 miles. Flying time, 135 hr. 55 min.

London-South Africa, February 4-*March* 5, 1920.—Sir Pierre van Ryneveld and Sqn. Ldr. Sir C. J. Quintin-Brand. Distance, 6,281 miles. Flying time, 92 hr. 58 min.

Schneider Trophy Contest, 1929.—Winner, Flt. Lt. H. R. D. Waghorn, in Vickers-Supermarine S.6 with Rolls-Royce R engine. Speed, 328.63 m.p.h.

Schneider Trophy Contest, 1931.—Winner, Flt. Lt. J. N. Boothman, in Vickers-Supermarine S.6B with Rolls-Royce R engine. Speed, 340.8 m.p.h.

Supermarine Spitfire eight-gun fighter monoplanes with Rolls-Royce Merlin engines. The Spitfire, in service in large numbers with the R.A.F., is officially credited with a maximum speed of 367 m.p.h.

FROM the CLUBS and SCHOOLS

Flying and Social Activities : C.A.G. News

WITNEY.

FLYING time for the week ended July 22 was 71 hr. 15 min. Messrs. J. Buckmaster, M. Vivian, A. S. Binning, G. Fryer, T. Thomas and T. Cole have gone solo.

CINQUE PORTS.

Seventy-six hours' flying time was recorded during the week ended July 22. Messrs. Roberts and Best flew solo.

PLYMOUTH.

The total flying time for the week ended July 17 amounted to 80 hr. Mr. R. Drew has gone solo.

ISLE OF WIGHT.

Flying time for the week ended July 16 amounted to 86 hr. Miss J. E. Newitt, Messrs. G. D. Bunch, J. Barrett and M. A. Wray have gone solo

YAPTON.

Over 111 hr. have been recorded since July 1 by club and C.A.G. members. Very high winds and rain have seriously curtailed all flying instruction.

PORTSMOUTH.

C.A.G. and club members have recorded 202 hr. since July 1. Sixty-three members of the C.A.G. are now flying solo, and 166 members are now under instruction.

SOUTH COAST.

Bad weather has greatly curtailed flying instruction during the week ended July 22. The result of the competition for the Zoe Beadle Trophy, held on July 16, was: 1st, Mr. C. E. O'Rourke; 2nd, Mr. J. White; 3rd, Miss C. Bradford.

DONCASTER.

During the week ended July 15 67 hr. 22 min. were flown. Mr. S. Laughton carried out his first solo. Flying time for the week ended July 22 amounted to 55 hr. Mr. Perry carried out his first solo. A new Moth Minor has been added to the club fleet.

IPSWICH.

Good weather during the week ended July 17 enabled 126 hr. to be flown. On July 15, at the invitation of the Mayor and Mayoress, Ipswich was "at home" to nearly 70 officers and men from Nos. 9 and 110 (Bomber) Squadrons.

NORFOLK AND NORWICH.

Seventy-five hours' flying was recorded by club and C.A.G. members during the past week. Mr K. Rice has successfully completed his first solo flight. Two C.A.G. members have also gone solo. Mr. E. A. Redfern took a machine on a cross-country trip to Brough and Hull. Several other cross-country flights have been made.

WEST SUFFOLK.

A total of 40 hr. was recorded during the week ended July 23. Messrs. R. S. Bower and A. Driessen have joined the clubs as new members, and Miss B. Hall, Messrs. B. S. B. Johnston, P. J. Palmer and E. R. Stewart have joined the C.A.G. Two of the club's machines took part in the "dawn patrol" arranged by Ipswich Aero Club.

REDHILL.

Total flying time for the week ended July 22 amounted to 130 hr. 45 min. Messrs. P. H. Mason and R. E. Finch have gone solo. The first of four Moth Minors on order has been delivered. There will be a garden party and air display in aid of the G.A.P.A.N. Benevolent Fund on July 29. [Details appear on page 94.—ED.]

THANET.

A total of 206 hr. was recorded during the week ended July 17. Messrs. J. Claxon, C. McLaverty and R. H. James made their first solo flights.

HANWORTH.

During the week ended July 20, 82 hr. were recorded by club and C.A.G. members. Messrs. C. W. Jarratt, M. S. Barrett and G. S. Marsh have made their first solo flights.

MARSHALLS'.

Flying time for the week ended July 22 amounted to 175 hr. 30 min. In the C.A.G. section Miss J. A. McCombie and Mr. K. G. Mason carried out their first solos.

NORTHAMPTON.

Bad weather greatly reduced flying time for the week ended July 21. New members of the club are Messrs. C. Austin, A. R. Warwick and G. Knight.

EXETER.

Over 125 hr. were recorded during the week ended July 17. Messrs. A. d'Arcy Hughes, C. R. Whytt and A. H. Cater made their first solo flights. An R.A.F. visit by two Ansons provided interesting discussion.

BROOKLANDS.

Adverse weather conditions reduced flying time to 95 hr. this week; however, Messrs. Lawson, Jarvis, P. V. Watson and Mackenzie-Veale went solo. The local squadron headquarters of the Air Defence Cadets will be closed from August 5 to 19, when the Cadets go to the summer camp at Shoreham.

HERTS AND ESSEX.

Rainstorms and high winds during the past fortnight limited flying; however, 229 hr. 30 min. were recorded. One of the D.H. Moth Minors has been delivered. Messrs. G. Jailler, D. H. Mellows and H. W. Brooks have made their first solo flights. Messrs. P. G. Cane, G. Tharpe, D. M. Chaston, T. H. Neilson, V. W. Lea and J. K. Croft have joined the Club as new members.

OVERSEAS.

RAND.

During the month of June 577.17 hr. were recorded. Miss P. M. Nash, Messrs. R. C. Dowsett and N. E. R. Saner have gone solo. Total flying time in the gliding section was 6 hr. 46 min.

SALISBURY (SOUTHERN RHODESIA).

During June 182 hr. were recorded—a record for the club. Nearly half of this total was flown in dual instruction.

BENGAL.

Flying time for the month of June totalled 105 hr. 10 min. Mr. F. Gloeckle flew to Midnapore and back in the Tiger Moth. There are now 82 European and 134 Indian members of the club.

KARACHI.

Flying time for June amounted to 112 hr. 55 min., and 17 hr. 45 min. were spent on the Link Trainer. The club has made further reductions in flying charges.

HYDERABAD.

Flying time for the month of June amounted to 79 hr. 55 min. Nawab Syed Kazim Hussain and Mr. P. M. Reddy made a dual cross-country flight to Bangalore. Capt. J. M. C. Hoblyn flew to Poona. Mr. Sabir Abid Ali has joined the club as a new member.

Forthcoming Events

JULY.

Fri., 28th-Sun., 30th. Cannes Aero Club: Deauville-Vichy-Cannes Rally.

Sat., 29th. Civil Aviation Benevolent Fund Air Display, Redhill.

Sat., 29th-Sun., 30th. Frankfurt International Flying Meeting.

AUGUST.

Sat., 5th. Cinque Ports Flying Club: Folkestone Aero Trophy Race.

Sun., 6th. London Air Park Flying Club: Garden Party.

Sat., 12th. Eastbourne Flying Club: Flying Display and Garden Party.

SEPTEMBER.

Sat., 2nd. King's Cup Race and Wakefield Trophy Race, Birmingham.

Sun., 3rd. Gordon Bennett Balloon Race, Poland.

Sat., 16th. Cinque Ports Flying Club. Wakefield Cup Race.

Sat., 23rd. Cardiff Aeroplane Club. London-Cardiff Race.

OCTOBER.

Sun. 1st. Aero Club de France. Coupe Deutsch de la Meurthe, Etampes.

Mon., 2nd-Sun. 17th Milan Aero Show

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

AIRSHIPS

"Their End is Not In Sight": Capt. F. L. M. Boothby's View

DOES not Mr. Miles Henslow, in his article on the cessation of Zeppelin production, somewhat under-estimate the "absolute ceiling" of LZ130 in war trim when he puts it at 10,000 feet? To multiply this figure by three might result in an over-estimate, but, surely, would be nearer to the truth. Be that as it may, the place for the airship in war is not over anti-aircraft guns, but far away over the oceans, where she forms the cheapest and most efficient vessel for scouting purposes.

We have yet to see the real beginning of the use of airships with the Fleet—their abolition by Lord Trenchard was not their end.

Their revival for commercial work is not likely to come when subsidies can be had for the asking by aeroplane transport firms, but a wave of economy invariably succeeds a period of spending such as that we are now passing through, and when the taxpayers' money is no longer available to make good losses, these firms are likely to take a real interest in airships of a non-flammable type—which does not necessarily mean helium-filled.

Despite the misfortunes of the Zeppelin firm, which will, I feel sure, make yet another recovery, the end of airships is not in sight.

F. L. M. BOOTHBY.

FLYING FOXES

—They Really Do

IN reference to "A.Viator's" recent note in his "Week at Croydon" may I be permitted to correct the impression that flying foxes do not fly? Not only do they do so, but they are exceptionally strong on the wing, though, as your contributor suggests, they do seem to have a somewhat high wing loading.

I may mention that these animals, whether birds, quadrupeds or, as I prefer to think of them, bats, are a favourite food with certain castes in India. I have shot several hundreds of them on behalf of my Saices, who, when the foxes were coming over, would come and ask to have some of them shot for them. They came over many hundred per hour, flying not from tree to tree but over some miles of marsh and open grassland; and on being fired on would give as good a display of aerobatics as Sqn. Ldr. Atcherly or any other R.A.F. expert.

My H.A battery often brought down twenty or more in the half hour the flight lasted, and contentment thereafter reigned in the stables for some days.

P. A. HYDE.

London S.W.1.

THE SHORT G-CLASS BOATS

Some Comparisons

I HAVE read with particular interest your description of the new Short G-class flying-boat. Some time ago I happened to make a comparison between this boat and the Boeing 314, with mystifying results.

Briefly the Golden Hind is about 20 m.p.h. faster and has a greater disposable load, despite its smaller dimensions:

	SHORT	BOEING
Speed:	209 m.p.h.	190 m.p.h.
Disposable load:	34,600 lb.	33,955 lb.

It should follow, then, that the smaller boat with engines of lower power must carry a greater payload for a range of 3,200 miles. That the Boeing does in fact carry a greater payload seems, on the face of it, utterly fantastic.

To carry the load it does, the 314 must break all preconceived ideas of fuel consumption. Just what this figure is I am not certain, though it is probably between 0.37 and 0.39 lb./b.h.p./hour.

To put it another way, if the fuel consumption of the 314 were the same as the new Short G, the former would not have any Atlantic payload at all; in fact, the still-air range would fall below 3,200 miles.

In your description of the new Short you make this amazing statement: "Any one of them could fly something like 6,000 miles non-stop . . ." To do this, the gross weight would have to be increased something like 17,000 lb!! The ultimate range is, in fact, approximately 3,700 miles when cruising at 70 per cent. of power.

THE G-BOAT takes the air—a *Flight* photograph at Rochester last Friday.

By reducing speed to 150 m.p.h. it is just possible that an ultimate range of 4,400 miles would be possible.

I must confess that I don't see much point in using these new G-class boats for the North Atlantic run, unless they can carry more than 4,250 lb. of mail. The C-class long-range boats have a C. of A. for take-off at 50,500 lb., therefore their Atlantic payload is 3,500 lb. of mail without flight-refuelling, and 6,000 lb. with this assistance. There would be no technical objection to using 100-octane fuel for take-off in these boats; they could then take-off easily at 53,000 lb.

The American Consolidated 28-5 seems to have arrived too late in the day—the new Saunders-Roe Lerwick makes it look somewhat antiquated, to say the least. The Air Ministry seem to have a childishly absurd habit of spending millions in purchasing aircraft from over the Atlantic that are technically very much inferior to our own products. They rather remind one of the lunatic who went about bashing himself on the head with a spanner.

London, N.W.3. "SIMPLE JOHN."

FOWLER FLAPS

An Interesting Commentary from Yeovil

WE at Yeovil have studied with the greatest interest the article on "outsize" aircraft by Mr. Robert C. Morrison in *Flight* of June 29—particularly that part relating to the Fowler flap.

We notice on page 649 the statement that a much larger horizontal tail is necessary than with the slotted flap. We have carried out a vast amount of experimental work in our wind tunnel on this very problem, and can give our conclusion that with proper attention to the disposition of the tail organs, and also the position of the c.g. in relation to the wing, much of this big increase of area is avoidable.

In this connection it is essential that the problem of stability and control with Fowler flaps shall be given priority at the inception of the design, as it is quite impossible to correct any errors at a later stage in the work. Broadly speaking, the problem consists of reaching a compromise between two conflicting requirements, the first of which is the provision of adequate stability in normal flight, while the other is the provision of ample control for stalling the aeroplane with the Fowler flaps extended. The second condition is simplified by allowing the c.g. to be situated fairly well aft, while the former, of course, is simplified by having a forward c.g.

There is a movement throughout the industry towards bigger tails, and it appears to us that it is very questionable whether the Fowler flap leads one into any considerable increase as compared with other types flying to-day.

The reference to large-area slots sliding forward in conjunction with the Fowler flap also interests us greatly, but I am afraid we are unable to say anything about this at the moment.

We ourselves have a high opinion of the Fowler flap, and we feel certain that others in the industry will also be interested in the problems associated with them.

In conclusion, may I express our great appreciation of this valuable article?

W. M. WIDGERY,
Experimental Engineer, Westland Aircraft, Ltd.

Yeovil.

HERE and THERE

Britain at the Milan Show

BRITAIN is to be officially represented at the Milan Aero Show, which takes place from October 2 to 17. A space of 3,000 square metres—nearly a quarter of the total floor area—has been booked to display this country's aircraft, engines and accessories.

Last year only a few British firms, exhibiting independently, were represented. It is said that the decision to support this year's show officially is welcomed in Italian commercial circles, if not in official ones, as evidence of a friendly attitude on the part of Britain.

OB—QB1!

AN enterprising B.B.C. outside broadcast last week sent two Royal Air Force direct-entry observers of only three weeks' experience to navigate a test course in a D.H.86B. A Wing Commander flew the machine according to their instructions, and a B.B.C. commentator described what happened while it was happening. The idea was that each navigator should fly a leg of the course, one from Hendon to Watton-at-Stone (near Ware—on the way to Cambridge, vide Mr. Will Hay) and the other from Watton to Hemel Hempstead.

The pilot, Wing Cdr. Anderson, C.O. of No. 24 (Communications) Squadron, was to do exactly what his novice navigators told him; afterwards he would award marks.

The fact that the 86 got farther and farther off its course, and eventually became completely lost, with pilot, navigators and commentator tending to dissolve into helpless laughter, was no real fault of the trainees, for, soon after the flight started, rainstorms reduced visibility to a few hundred yards. At the end—and Mr. C. J. T. Gardner, the B.B.C. commentator, all but admitted the fact to (is it?) seven millions doubtless slightly-bewildered listeners—they had to fall back on the ever-faithful Mr. Bradshaw.

It was much more fun than if things had gone according to plan. And congratulations to the B.B.C. technical folk—who had, we believe, installed the famous "boat-race transmitter" in the 86—on the excellence of the transmission. It was in very marked contrast to most air-to-ground speech, which usually suggests the frightened falsetto of somebody calling for help with his head inside a wasps' nest.

The Air League Meeting

THIS year the annual general meeting of the Air League of the British Empire was held at the new premises of the Royal Aeronautical Society, with the Duke of Sutherland, president of the League, in the chair.

He recalled that when Lord Mottistone took the chair at last year's meeting we were living in troubled times, and that by September of that year the shadow of war had descended upon us. Now, fortunately, we need fear no military competitor in the air, and on the ground we were organised against air attack in a manner remarkable in a democratic nation wedded to the cause of peace. He thought that to have achieved this was the greatest success that the Air League could have attained by its insistent propaganda. He hoped that some day the League's propaganda for British leadership in civil aviation would bear equal fruit. At present we were lagging behind, and it would be difficult to catch up if we left the effort too long.

His Grace also referred to the great success the Air League had had with Empire Air Day and with the Air Defence Cadet Corps. The latter now numbered 160 squadrons. He expressed thanks to Marshal of the Royal Air Force Sir John Salmond and Mr. Simon Marks for the help and the time they had given to the Corps, and to Lord Nuffield for his gift of £10,000.

Air Comdre. Chamier, Secretary-General of the Air League, regretted that Mr. W. O. Manning, treasurer of the League, was not able to be present, and explained that the accounts of the League showed a profit of £638, compared with a loss last year of £466. This was due mainly to the donations item, which was higher by about £700.

He also explained that the Young Pilots' Fund, established originally to help young fellows to learn to fly, had rather lost its usefulness now that we had the C.A.G. scheme and the R.A.F. Volunteer Reserve, and that, consequently, the committee had decided to use some of the money from this fund to help young men in the Dominions.

Lord Strabolgi, in seconding the adoption of the annual report, said that indications were that at the present time the R.A.F. "had its tail well up" (a quotation from a report by Sir John Salmond to Lord Trenchard during the war). It would be a mistake, however, to think that because of this the Air League had finished its work. When the present troubles of the world were more at rest, it would be the Air League's duty to see to it that this country never again sank to the position in which it found itself three or four years ago.

The annual report was adopted, and the Duke of Sutherland was re-elected president. The Duke of Richmond and Gordon was elected deputy president. Mr. W. O. Manning was re-elected hon. treasurer and deputy chairman. Resignations from the executive committee by Lord Mottistone, Lord Clydesdale, Sir Basil Clark, Cdr. Southwell and Capt. R. L. Preston were accepted, the three first-mentioned having consented to become vice-presidents.

Keith Kendle Brown

ONE of the best known and liked club instructors, Mr. Keith Kendle Brown, lost his life last week when the machine in which he was flying with a pupil came into collision with a Hawker Hart over Tilmanstone.

"K.K.," who was chief instructor at the Kent Flying Club, Bekesbourne, was for many years the chief instructor at the Cinque Ports Club, Lympne. He was born in Australia in 1901 and joined the R.A.F. in 1922. Before going to Lympne in 1929, he was chief instructor of the Nottingham Aero Club. His death is all the more regretted because it was caused by circumstances more or less outside his control. All who knew him will remember "K.K." as a competent and careful instructor, and as a man in whom modesty was almost a fault.

Roll Up to Redhill!

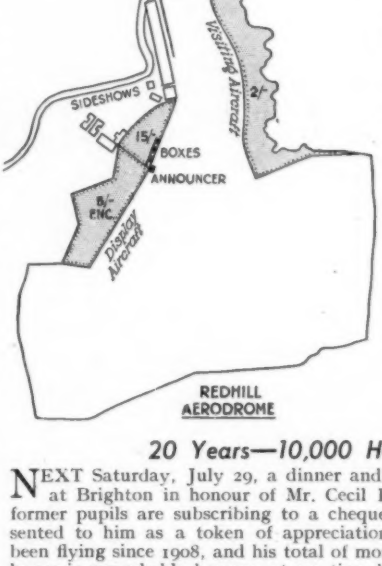
REPRODUCED on this page is a plan of the enclosure arrangements for the Civil Aviation Benevolent Fund Display and Garden Party at Redhill Aerodrome, next Saturday, July 29, starting at 2.30 p.m.

All visiting pilots are asked to arrive before noon to relieve congestion of the aerodrome. Food and drink will be available at this hour, and all the sideshows will be open.

Those coming or going by car are particularly asked to keep to the signposted roads.

As to the flying, the Cunliffe Owen "Flying Wing" will be among the aircraft demonstrated, and it is hoped that the *Golden Hind* will be able to appear. Other items will include a short-course race; demonstrations of the direct take-off Autogiro and of sailplanes and gliders; aerobatics on a Tiger Moth by Mrs. Winifred Crossley; and an obstacle race. R.A.F. participation is also likely, but details not to hand.

Copies of the souvenir book, *How we Fly*, will be on sale in aid of the fund, and it is the hope of the organisers that the public, aeronautical and otherwise, will turn up in really large numbers and thus benefit the same good cause — which is that of the commercial pilot or his dependants.



The arrangements at Redhill. Car parking is 2s. 6d., children are half-price, and advance tickets are obtainable at British Airways Terminal House, Grosvenor Gardens, London, S.W.1, or at the usual agencies.

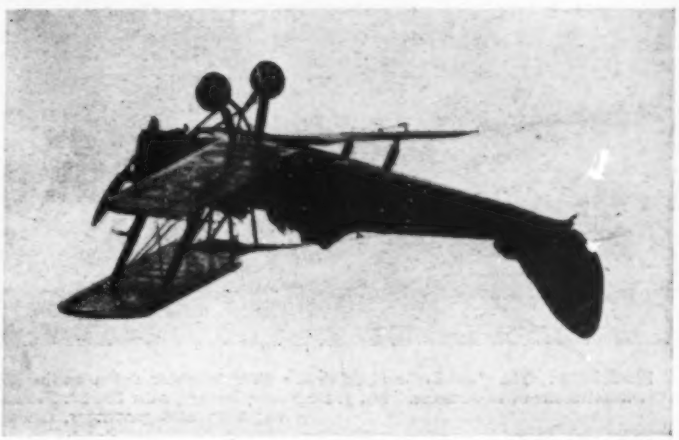
20 Years—10,000 Hours

NEXT Saturday, July 29, a dinner and dance is being held at Brighton in honour of Mr. Cecil Pashley; friends and former pupils are subscribing to a cheque which will be presented to him as a token of appreciation. Mr. Pashley has been flying since 1908, and his total of more than 10,000 flying hours is remarkable because at no time has he been engaged in airline work. All those interested are invited to communicate with Mr. Francis F. Haddock, of 14, Carfax, Horsham, Sussex.

Topics of the Day *"Indicator" Goes in for—*

A LITTLE BLIND FLYING

—and Records Some Impressions: Queer Psychology and Still Queerer Physiology



"Flight" photograph.

NOWADAYS there is nothing to be considered as new about blind-flying as such, and probably dozens of people have written tens of thousands of words about the ways and means thereof. Nevertheless, a few weeks ago, when I really *had* completed a blind-flying course—after a great many half-starts and longer periods of useful experience—I put down most of my outstanding and more immediate impressions, some of which may be useful to pupils and amusing to the real experts.

By way of a start I may say that, after a good many hours in the starboard front seats of transport aeroplanes, I had come rather firmly to the conclusion that only free gyro instruments—i.e., directional gyros and artificial horizons—were really satisfactory for serious blind flying, and that a turn indicator was to be considered nowadays only as a safety addition in case the machine got into some really extraordinary attitude, or in case the rather more sensitive free-gyro instruments gave trouble.

Probably with the modern type of aeroplane, the turn indicator, treated as the sole blind-flying instrument, would be rather difficult. These modern aeroplanes are so rigidly stable directionally that the ordinary means of correction in a standard blind-flying course might hardly apply. For instance, the business of centralising the turn needle first of all on the rudder might not be too easy, because many present-day machines can be turned only on the ailerons, and the use of the rudder merely yaws the machine one way or another without starting a turn. But that is as it may be.

What I did discover during the course was that, at least with a "conventional" aeroplane, once one becomes accustomed to its use, the turn indicator is just as easy to fly on as any other gyroscopic instrument. It may seem, for a start, that the indications and corrections are a little unnatural, but in the end there is almost less concentration required than in flying a machine in similar weather conditions against the true horizon.

Curious Impressions

The great thing is, so to speak, to lock out all your sensations and to make yourself into a kind of instrument-reading and correcting automaton. That, as lots of people have already said, is the basis of blind-flying training. In other words, you must believe the instruments implicitly, and I am quite certain that those pilots who find a continuous period of blind flying in bumpy weather to be somewhat nerve-racking have simply been unable to master their natural reactions. The nerves are torn up simply because there is a continuous battle going on between the knowledge that the instruments are telling the truth, and the undefeated feeling that they are all wrong.

Sometimes one gets most peculiar ideas which are not at all borne out by the record of the instrument panel. At one time I flew for quite half an hour with the firm conviction that the machine was at a lateral angle of forty-five degrees. If I had really been flying blind in tough conditions, that feeling might eventually have reduced me to a state of nervous panic. In the safer circumstances of training, I was merely rather amused, and put the sensation down to the fact that the Sutton harness was tighter on one side than on the other. When this sort of thing crops up it helps to fly for a few minutes with one's left hand.

Once this business of the complete segregation of mental reaction from physical sensation has been settled, even spins no longer make one feel ill. As the majority of pilots know, the first impression when spinning under the hood is that, when the spin has really been stopped, the machine is spinning much more rapidly in the opposite direction. When you have reached a point of real instrument concentration that feeling, though still present, is so entirely ignored that it might not be present at all.

Unfortunately, perhaps because one has less practice in controlling the machine in the fore and aft plane, a brand-new and equally false sensation takes its place. During recovery you are quite convinced that the machine is pointing vertically towards the earth, and that you are hanging forward in the harness.

Spin Recovery

Hence, I believe, what is probably the most usual fault in spin recovery—that of permitting the machine to stall again almost immediately afterwards. The only way out of the difficulty appears to be to follow the book of words and to apply corrections more or less by numbers. First, full opposite rudder against the turn indicator, with the control column in the neutral or a little ahead of neutral position; when the needle has rushed over to the opposite side and shows signs of coming back to the centre, the rudder should be approximately centralised. By the time the needle has been fought, on the rudder, back to its proper central position, it is quite time to start holding the control column forward quite strongly and, at the same time, to open the throttle.

If you have not been too long in the needle centralisation process, the speed by then will have dropped down to 70 or 80 m.p.h. (you'd be surprised at the machine's attitude!), and it will be time to prevent the machine from see-sawing out of its dive. Curiously enough, until you start this blind flying, you never realise how, at a comparatively high speed, a machine has such a strong tendency, when normally trimmed, to lift its nose right above the horizon. Nor, until you glide under the hood, will you have realised how much pressure is required on the rudder to correct the spring bias which keeps the machine more or less straight when the throttle is open. During the first few periods of blind-gliding in a Tiger Moth, one's right leg aches in quite a remarkable way, yet it never appears to ache when you are in the open air. Really, the Air Ministry ought to subsidise a few tame psychologists.

(To be concluded.)

COMMERCIAL AVIATION

"Flight" photograph.

FLEDGED : The short G-class boat *Golden Hind* touching down on the Medway last Friday after her first flight—an entirely successful one of 16 minutes. Mr. J. Lankester Parker, with Flt. Lt. E. Moreton as assistant pilot and Mr. George Cotton (chief engineer) as a passenger, made the test.

THE WEEK AT CROYDON

Misleading Headlines, Necessary Showmanship, Undercarriage Rights, Hangar Christening and Obstructions : "A. Viator's" Transport Commentary

IF the wrong end of the stick was the bright-red end of a red-hot poker, some of the sub-editors of our daily papers would not fail to take a firm and friendly grip of it. The other day I was glad to see that the misleading headline racket had been exposed in Parliament, for I have never forgotten the clever lad whose headline (for which he doubtless achieved promotion and a presentation gold watch) ran as follows: "Crash at Croydon."

Many a worried relative of a pilot or air passenger doubtless bought the paper that evening and, taking things all round, the circulation of the paper rose by perhaps one hundred—which is eight and fourpence, less discount. The crash at Croydon was a collision between two motor cars in Croydon High Street.

Last week's stunt was a photograph of Gen. Sir Edmund Ironside, after arriving at Croydon from Warsaw, holding his hands to his ears, probably because a machine was running up on the tarmac. Next to the General's picture was one of the biggest guns in the German army—in the act of firing. "Not so deafening," said the caption beneath the two photos, "was the noise of the aeroplane engines, etc." Everybody knows, including kindergarten scholars, that the modern aeroplane is less noisy inside than an express train.

Hints like these are liable to cause people to refrain from air travel and they are paralleled by the silly yarns one hears about air sickness—which, in these days of overweather flying, is almost unknown.

Incidentally, I think it a pity that such fine figures as Gen. Ironside, when representing the Nation, do not travel in uniform to Continental countries. A bowler hat and lounge suit seems scarcely to fill the bill when arriving or departing from a foreign aerodrome where there is an official welcome or send-off. As a nation, we back showmanship and even the Bishop of Winchester, who left Croydon by K.L.M. on Saturday for an Ecclesiastical Conference in Amsterdam, travelled in mufti. No gaiters and no apron. I agree, of course, that we can afford to wear mufti without looking like third-rate carpetbaggers, whereas some nations can't and even have to put their reporters into uniform.

There is a quaint yarn filtering through the clubs, pubs, temperance hotels, and other dives haunted by commercial air people and I give it for what it is worth. A firm running internal lines has had, they say, no end of letters from its old-fashioned clients protesting against these new-fangled retractable undercarriages which one old lady referred to as "collapsible" undercarriages. "The passenger is king," so the firm asked the manufacturer to fix the undercarts of future models, especially as (a) the retractability only gave an added speed of about 8 m.p.h. and (b) because a retractable undercart is an expensive item. For some reason not quite clear, the manufacturer is indignant and more or less insists on supplying "put and take landing gear," despite the operator's wishes.

Now, I am entitled to a car without a sunshine roof if the latter luxury is useless to me, and it seems that the retractable undercarriage is useless to the airline operator in this case and even liable to be a nuisance. I am the more amused because I remember the days when manufacturers in this country refused to supply retractable undercarriages at any price.

Old Wine . . .

A solemn sight a day or so ago was the progress, backwards and tractor towed, of those notable machines, *Heracles* and *Scylla*, apparently proceeding to the Chelsea Hospital for veteran aircraft—the hangar on the edge of the airport where the two ex-International Air Freight machines dream away their days and grow long green fungoid beards. They, it will be remembered, were bought by a bustling Air Ministry with taxpayers' money for immediate conversion into aerial class-rooms for navigators.

But the veterans, *Scylla* and *Heracles*, did not retire to the hospital but proudly entered the *new* hangar which the Air Ministry has just erected—thus, as you might say, christening that building. The ceremony might have been more impressive if one of the poor old things had not fallen into the drainage system which flows beneath the hangar floor and which Works and Bricks had temporarily covered with bits of three-ply painted to resemble concrete. W. and B. will have their little joke!

It is now proposed that any new buildings built by the Air Ministry, including the new wings to the terminal building, should be first tested by means of a lorry-load of high officials. If the floor gives way or the roof falls in, we shall know that the place is unfit for human habitation.

INDICATOR.

COMMERCIAL AVIATION (CONTINUED)

Trans-Pacific

AUSTRALIAN press reports state that a party of Pan-American Airways officials and engineers have arrived at Noumea, capital of the French colony of New Caledonia, to survey a new base. This base, with another in the Phoenix Group, will apparently replace the old ones on Kingman Reef and Pago Pago—used for the route which the first trans-Pacific service from California to New Zealand followed. The change is probably due to the fact that Kingman Reef is almost awash at high tide and a large depot ship would be a necessity if the base were to be continued there. Agreement to use Noumea has already been reached between America and France.

The Imperial Atlantic

IN last week's issue we explained that the first British trans-atlantic air mail service would start on Saturday, August 5, using two of the modified "C" class boats, *Cabot* and *Caribou*. It is now learnt that the first flight, probably by *Cabot*, from Foynes to Botwood, Montreal and New York, will be in charge of Capt. J. C. Kelly Rogers and the machine is expected to start its return journey on August 9. The second outward machine, leaving on August 12, will be in charge of Capt. D. C. T. Bennett. Three other pilots, Capts. A. C. Loraine, A. G. Store and S. G. Long, have now been transferred to the Atlantic Division, which is in charge of Capt. A. S. Wilcockson. Capt. J. W. G. James, in addition to Kelly Rogers and Bennett, is already with the Division.

High-Speed Delivery

LATE last month, between June 27 and June 29, a Focke-Wulf Condor was delivered by air in high-speed stages to the Condor-Syndikat (appropriately enough), the Brazilian-German operating company. Conveying a crew of six, including two from the Condor concern, the machine was flown from Berlin to Seville and thence to Bathurst, Natal, and Rio de Janeiro.

The first stage, a distance of 1,500 miles, was covered in 7 hr. 57 min.—an average speed of 190 m.p.h. After a stop of an hour and a half, the Condor left for Bathurst, flying the 2,045 miles in 10 hours at 204 m.p.h. Again only a short stop of two and a half hours was allowed and the next 1,890-mile jump to Natal was flown in 9 hr. 47 min., giving an average of 196 m.p.h. The final section, 1,460 miles long, was flown in 7 hr. 4 min.—at 207 m.p.h. Thus, the Condor, which has been named *Pommern*, flew 6,900 miles in 34 hr. 48 min., averaging 197 m.p.h. The total time was 40 hr. 54 minutes, including stops, so that the all-in speed was 168 m.p.h.

Imperially Criticised

AT last week's Empire Chambers of Commerce Congress in London both criticisms and commendations were expressed in the discussion on Empire air communications. The congress adopted a resolution welcoming plans for the carriage of all first-class mail by air, but regretting the delay in starting a British service in the West Indies, "viewed with apprehension" the postponement of a British service across the South Atlantic, and hoped for an early service between New Zealand and Canada.

Sir George Macdonogh said that the picture of British over-sea air transport was not entirely a bright one. American services had been run for several years through the British West Indies, and a British service there had been considered since 1926. French and German air services had been in existence over the South Atlantic for some time, and an Italian service was under way, while Americans had been flying the Pacific for nearly three years.

More serious criticisms were voiced by Mr. E. Greenacre, from Durban, who said that a four and a half days' service from Southampton to Durban had been promised, but they never knew when the letters would leave. One letter he sent took 26 days, or nearly double the steamer time, and often letters took seven, eight or ten days. They used to know to an hour when to expect mails by sea.

Other delegates pointed out that British Guiana was entirely dependent on American and French services and that Imperial Airways had not yet replaced *Cavalier* on the Bermuda service, with a consequent loss of prestige.

In reply, Imperial Airways told the *Daily Telegraph* that, in the three months prior to July 17, only six out of 56 services to Durban failed to arrive on time.

The Constance Accident

ONE of the best-known Swiss pilots, Capt. W. Ackermann, M. Lips of Swissair, a wireless operator and three passengers were killed when the Swissair Junkers Ju.86 crashed while coming in to land at Constance aerodrome on July 20. The machine, which is used for the Zürich-Vienna run, apparently suffered the failure of one engine and was being brought in to Constance when, according to reports, the second engine stopped. If the reports are correct, the evidence points towards fuel failure.

More Traffic

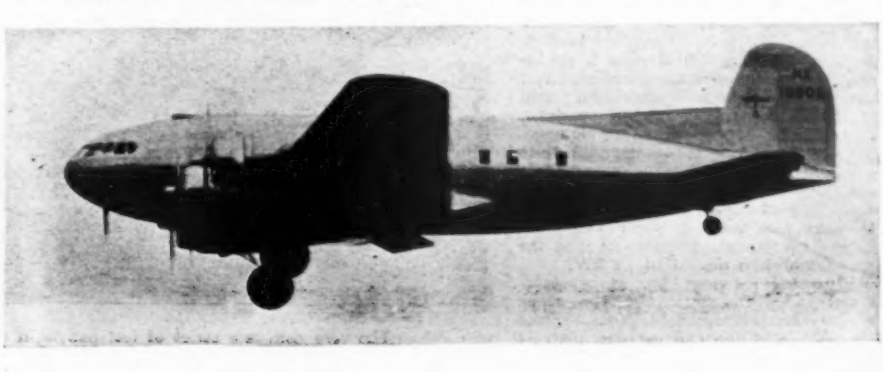
AIR France reports that more people have left by air for holidays in the South of France during the present month than in any other period during the company's history. To cope with the increased demand for through bookings to the Riviera it has been necessary to extend one of the daily services, normally terminating at Marseilles, to Cannes.

Incidentally, by arrangement with Pan-American Airways, passengers arriving by Boeing from New York will be met at Marseilles by Air France on the Fridays July 28 and August 4, 11, 18 and 25, whence they will continue their journey to Paris and London by Marcel Bloch. The sending of this machine to Marseilles has enabled the company to accept bookings for an additional London-Marseilles service on these dates. Leaving Croydon at 0900 hours, Marseilles is reached at 1340 hours.

The "Flammarion" is Tested

SINCE the beginning of July, when it was taken up for its first flight at Toussus Le Noble, Air France-Transatlantique's new Farman landplane, "N.C.2234," has been exhaustively tested in preparation for high-altitude flights over the North Atlantic this summer. This 4-engined machine—now named *Camille-Flammarion*—is a sister ship of the *Laurent Guerrero*, in which Codos set up the Paris-Santiago de Chile record 18 months ago.

At Toussus Le Noble it completed its tests for manœuvrability and consumption, then made its first cross-country flight to Istres to undergo load-carrying tests. It was the intention to push up the load to 23,000 kg. (50,700 lb.) at the take-off and here are the actual results. Weighing 20 tons, it left the ground in 22 seconds after a run of 495 metres against a 15 m.p.h. wind. A few days later it took off in still air and weighing 22 tons in 26 seconds after a run of 750 metres. Finally, at a 24-ton total weight, again with no wind, it took 30 seconds to unstick after a run of 816 metres. The speeds recorded were as follows: At 10,000 feet, 231 m.p.h.; at 15,000 feet, 200 m.p.h.; at 20,000 feet, 182 m.p.h. The 4 Hispano 12y 39 engines (2 pairs in tandem) give a total of 3,600 h.p.



THE NEW STRATOLINER: As already recorded, the second Boeing 307 has recently been carrying out full-scale pressure-cabin experiments. The machine concerned, the 307 S., is remarkable for the extra fin area provided. Mr. Howard Hughes is shortly to take delivery of a special long range version of the 307, with tankage for 4,200 British gallons.

SPECIALISATION

Repairing and Testing Instruments and Electrical Equipment : The New Rollason Shops

"Flight" photographs.

(Left) At work in the air-conditioned instrument shop. (Right) Part of the specialised machine shop.

WHEN, early this year, we mentioned that a subsidiary of Rollason Aircraft Services was being formed, in order to deal with the repair and maintenance of aircraft instruments and electrical ancillary equipment, we remarked that the demand for such special servicing should be considerable. There is no need to emphasise the fact that the present-day flying methods depend for their safety on instrument accuracy.

Since that time, Rollason Aircraft Instruments and Equipment have come thoroughly into existence, with special instrument and electrical test shops, and an adjoining machine shop. Encouragingly enough, practically all the equipment used in these shops has been actually made, and, in most cases, designed, by the staff which will use it. Another point is that all this equipment and calibrating apparatus is able to deal with metric as well as English scales. A few of the items designed and built by the staff are an exhaust gas analyser test panel, a pressure gauge tester, hot and cold chambers, and test panels used for dealing very thoroughly with dynamos, starters, magnetos, batteries, thermocouples, tachometers and similar items. A good deal of work is done for the parent company, such as servicing portable electric tools, making up special equipment, planning new power and lighting circuits, to mention but a few items.

The panels, incidentally, are arranged along one wall, with two or three other interesting items for individual testing. A piece of equipment of note is an ingenious ball race extractor and replacer, also made at Rollasons, for dealing with blind-hole as well as normal bearings, without risk of side thrust or damage. A special under-cutter for trimming the mica on commutators, and a rotoscope designed to check speeds up to 6,000 r.p.m. are also to be found. R.A.I. and E. have also made up their own magnetiser equipment, designed to take the maximum shop output of 12 kW.

With the increased use of constant-speed and Hydromatic airscrews, some means of mixture checking has become essential, and the exhaust gas analyser is now considered as normal aircraft equipment. Consequently, the analyser test panel in the electrical department should be in considerable demand, particularly as it is an unusual item.

All standard instrument equipment can be tested and made up in the instrument test shop, which is air-conditioned and fully equipped. To quote a few examples, altimeters are tested against a standard barometer in temperatures varying between −40° C. and +50° C. The barometer used has scales reading in millibars, millimetres, metres and feet. Airspeed indicators are recalibrated against a water-pressure column, which is regulated in three scales up to 600 m.p.h., and the equivalent in knots and kilometres per hour. The instruments can also be tested for the standard of luminosity against a specially calibrated luminosity tester.

Both instrument and electrical shops have shadowless lighting and each work-bench is equipped with individual gas, compressed air, vacuum, and electric light points. Both departments have at their disposal a machine shop equipped with high precision modern machine tools. There are also the necessary bonded and quarantine stores for individual types of work. These shops have recently been approved by Air Ministry under 705 procedure, and also by the Air Registration Board. R.A.I. and E. will also be in a position within the next six months to carry out the servicing of all automatic pilots.

"Flight" photograph.

The very complete series of test panels in the electrical shop.

CAPT. H. H. BALFOUR visited East Cowes last Friday to open the new Saunders-Roe staff club. During his visit he inspected the Lerwick, subject of one of the largest flying-boat orders ever placed by the Air Ministry. Seen here during the club opening ceremony are (left to right, front row) Mr. A. T. White (managing director, J. Samuel White & Co., Ltd.), Mr. H. E. Broadsmith (director and general manager, Saunders-Roe), A. V.-M. Bowhill (O.C. Coastal Command), the Hon. Clive Pearson (director, Saunders-Roe), Capt. Peter Macdonald, M.P., Capt. Balfour, Mr. A. E. Chambers (chairman, Saunders-Roe), Capt. A. M. Fitzpatrick-Robertson, J.P., and Sir Alliott Verdon-Roe.

"Flight" photograph.

Messier Undercarriages: A New Company

IT is now possible to reveal the completion of an interesting industrial development in the North. The Liverpool Refrigeration and Engineering Co., Ltd., an old-established business at Sankey, Warrington, is being entirely reorganised, its refrigeration interests being disposed of and its attention turned to a general engineering division and an aircraft components division. The chief object of the latter will be the manufacture of the well-known Messier undercarriage, hydraulic actuating gear, remote controls, and other components.

In order to launch the new venture on a sound basis, the capital has been more than doubled, and a controlling interest has been allotted to Rubery, Owen, Ltd., of Darlaston. A previous association with Associated British Engineering, Ltd., is retained. The Refrigeration Company's name has also been changed to Rubery, Owen, Messier, Ltd.

The board of the new concern is constituted as follows:—

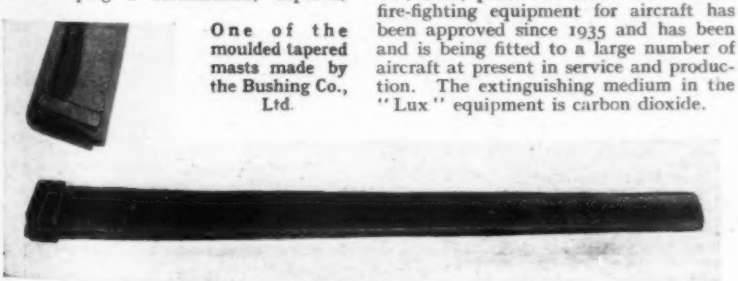
Mr. A. G. B. Owen, chairman (chairman of Rubery, Owen); Mr. L. S. Armandias (chairman, Aeronautical and Mechanical Inventions, Ltd.); Mr. A. P. Good (chairman, Associated British Engineering, Ltd.); Mr. R. J. Norton (director, Associated British Engineering); Mr. E. W. B. Owen (director, Rubery, Owen); Mr. H. S. Price (general manager, Rubery, Owen, Messier); Mr. S. Sanders, (director, Aeronautical and Mechanical Inventions).

Tapered Aerial Masts in Plastics

WRITING on the subject of moulded synthetic tapers, as used for aircraft radio masts, the Bushing Co., Ltd., of Hebburn-on-Tyne, state that they have been producing masts of this type since April, 1938, and are, so far as they know, pioneers in this particular kind of component.

In 1937, it is stated, they were approached by the Royal Aircraft Establishment, Farnborough, with a view to developing a streamlined, tapered, laminated plastic mast, and, as a result, they were able to produce a mast which received Farnborough's approval. Orders were received in November, 1937, for large quantities, and the Bushing Co. have been in regular quantity production since April, 1938.

The material from which the masts are moulded is known as "Texolex," and in a 47in. mast there is a taper from 6in. × 2in. base section, to 4¼in. × 1¼in. section at the top. An advantage claimed is that the wall thickness at the top is approximately half that at the lower end.



One of the moulded tapered masts made by the Bushing Co., Ltd.

Merlins on Water

A REALLY superbly produced brochure on the Rolls-Royce-Power-Merlin unit has recently been published by the British Power Boat Co., Ltd., of Hythe, Southampton, who are fitting this type of engine to their motor torpedo boats and other specialised high-speed craft.

The Power Merlin is the result of co-operation between the Rolls-Royce Company and Mr. Hubert Scott-Paine. Supercharged, and following the general lines of the Merlin aero engine, this twelve-cylinder Vee-type unit develops 1,100 h.p. at 3,000 r.p.m. from a total cylinder displacement of 27 litres. The engine uses 87-octane fuel. The chief differences from aeronautical practice lie in the fitting of a clutch and reverse gear box and in the method of cooling.

Aircraft Fire-fighting Installations

COMMENTING on a recent statement regarding types of fire-fighting installations standardised on Service aircraft, the National Fire Protection Co., Ltd., of Richmond, Surrey, state that they are at present executing an Air Ministry contract for several thousand "Essex" methyl-bromide extinguishers.

On the same subject, the Walter Kidde Co., Ltd., point out that their "Lux" fire-fighting equipment for aircraft has been approved since 1935 and has been and is being fitted to a large number of aircraft at present in service and production. The extinguishing medium in the "Lux" equipment is carbon dioxide.

Rubber that is Different

THERE are very few forms of rubber which do not deteriorate when subjected to the actinic frequencies of light, to climatic changes and to tropical heat. Admittedly it is possible to introduce certain chemical and physical properties in the normal manufacture of rubber which endows the product with certain definite resisting qualities, but to overcome physical deterioration in general calls for highly specialised methods in its production and original preparation. The basic material of most crude rubber is latex—the vegetable product of the para tree that has been coagulated by the addition of a weak acid solution. Latex is subjected to mastication between differentially geared rollers and finally exported from the plantations in the form of a thin sheet of crepe rubber—or it may be produced in thin sheets which are dried by smoking.

In this state the crude rubber is a tough, amorphous material which absorbs water and is soluble in certain liquids.

While there are many different manufacturing methods for the production of heat-vulcanised rubber, the general principles involved are in the main the same. The raw rubber sheet or crepe is cut into slabs and subjected to kneading and shearing, a breaking-down process which is sometimes accelerated by heat treatment and reduces the rubber to a semi-plastic state. Various ingredients such as sulphur, pigments, accelerators and fillers are then added. The now dough-like material is then heated in moulds at relatively high temperatures and pressures before the finished article is produced. In this process the rubber may lose much of its original nature. Its vegetable character changes and its structure become crystalline.

Some sixteen years ago Mr. Bernard Wilkinson, who was then carrying out research work in Malaya, conceived the idea of retaining the vegetable characteristics of the latex with the object of producing sheet rubber that would resist age without losing resiliency.

As a result of his experiments, Mr. Wilkinson found that it was possible to treat the fresh latex at atmospheric temperatures and by adjusting the Ph. value and introducing certain chemical agents, to release an active form of sulphur which is present in latex, while still preserving the microscopic vegetable structure. The result is that the finished product—which was given the trade

The Industry

name "Linatex"—contains over 90 per cent. of pure rubber in which only super-wetted, pseudo-colloidal chemicals and a colouring pigment have been mixed without any violent mastication or breaking down being necessary. After a period of standing the treated latex coagulates and the coagulum is machined at once into standard crepe of unit width and thickness. It is then dried for an average period of seven days before the thin sheets are laminated to any desired thickness. From these sheets all Linatex products are made.

It will be appreciated that as the Linatex has been cured or vulcanised by a natural process it is not possible to mould it, but by the use of a special cold cement which results in completely autogenous joints, it is possible economically to build up almost any desired shape or form. Several remarkable features are claimed for Linatex. It will not perish under any climatic conditions even if stored for long periods in the tropics, and it will not harden at low temperatures. It is from three to four times more resilient than other rubbers and consequently has greater resistance to abrasion than has any metal. Also, it is non-absorbent of moisture and possesses a specific gravity of 0.97. With the aid of a simple cold cementing process Linatex can be bonded to metals, wood, fabrics or concrete.

Because of its unusual resiliency and resistance to the actinic frequencies of light, Linatex is used in aircraft for mountings for knock-out panels and windows—as in the Short Empire flying boats; for use in buoyancy chambers and water-tight compartments where stringers, etc., pass through the bulkheads; for special weatherproof seals for doors and cowlings; and for a variety of specialised uses. Practically all British military aircraft now being manufactured are, it is stated, equipped with Linatex and the material is of particular service in the development of sealed cabin design.

Linatex is handled in this country by the Wilkinson Rubber Linatex, Ltd., 1-4, Great Tower Street, London, E.C.3.

"THE AIRCRAFT ENGINEER," the monthly technical supplement to "FLIGHT," will appear next week.

SHARING REPUTATIONS

MANY firms, by supplying materials and components, or carrying out machining operations, are contributors to the success of both the Rolls-Royce Merlin engine and the Miles Master Trainer, which are dealt with in this issue. Among these firms are:—

The Merlin Engine

H. W. KEARNS, LTD.—Boring of main bearing housings.
B. O. MORRIS, LTD.—Trimming of crankcase and cylinder block castings; supply of flexible-drive tools.
CHAS. CHURCHILL & CO., LTD.—Form-milling of crankshaft webs.
ALFRED HERBERT, LTD.—Automatics.
JAMES ARCHDALE & CO., LTD.—Machine tools.
ALFRED HERBERT, LTD.—Machining of supercharger diffuser vane ring.
A. C. WICKMAN, LTD.—Grinding of splines on air-screw shaft.
KENDALL & GENT (1920), LTD.—Milling of main bearing gaps.
ACCLES & POLLOCK, LTD.—Steel tubing.
ALUMINIUM CORPORATION, LTD.—Aluminium sheet.
THOS. BOLTON & SONS, LTD.—Drawn phosphor bronze.
JAMES BOOTH & CO., LTD.—Copper tubing, brass tubing, rods, strip and sheet.
BRITISH ALUMINIUM CO.—Aluminium tubing.
BRITISH INSULATED CABLES, LTD.—Aluminium rod, cables, etc.
DELTA METAL CO., LTD.—Brass, sheet, strip, rod and aluminium bronze.
ENGLISH STEEL CORPORATION.—Nitralloy steel.
SAMUEL FOX & CO., LTD.—Alloy steel, stainless welding wire, etc
HIGH DUTY ALLOYS, LTD.—R.R.50 ingots, alloy sheet and strip.
WM. JESSOP & SONS, LTD.—Valve steel D.T.D.49 A.
KAYSER ELLISON & CO.—Valve steel D.T.D.49 A.
REYNOLDS TUBE CO., LTD.—Steel tubing, R.R.56, alloy rod and tube.
P. STUBBS, LTD.—Valve spring wire.
AEROPLANE & MOTOR ALUMINIUM CASTINGS, LTD.—Alloy castings.
BIRMINGHAM ALUMINIUM CO., LTD.—Aluminium castings.
BRETT'S STAMPING CO., LTD.—Steel forgings, hot brass, bronze and aluminium pressings.
DERITEND STAMPING CO., LTD.—Steel forgings, hot brass, bronze and aluminium pressings.
WM. DEAKIN & CO., LTD.—Pressings.
DANIEL DONCASTER & SONS, LTD.—Drop forgings.
THOS. FIRTH & J. BROWN, LTD.—Steel forgings; alloy steel.
FIRTH-DERIHON STAMPINGS, LTD.—Steel forgings.
HUGHES-JOHNSON STAMPINGS, LTD.—Forgings.
M MOLE & SONS, LTD.—Pressings.
GEO SALTER & CO., LTD.—Stampings and steel pressings.
SMITH'S STAMPING WORKS (COVENTRY), LTD.—Steel forgings.
HERBERT TERRY & SONS, LTD.—Shafts, springs, etc.
TUBES, LTD.—Steel tubes.
HY WIGGIN & CO., LTD.—Monel metal, etc.
AMAL, LTD.—Flame traps.
BRITISH THOMSON-HOUSTON CO., LTD.—Magnetos, starter motors, generators.
BRITISH TYRE & RUBBER CO.—Rubber parts.
HOFFMANN MANUFACTURING CO., LTD.—Bearings.
K.L.G. SPARKING PLUGS, LTD.—Ignition and electrical parts.
RICHARD KLINGER, LTD.—Klingerit joints
LIGHT PRODUCTION CO., LTD.—Piston rings.
LION ENGINEERING CO., LTD.—Joints and pressings.
LODGE PLUGS, LTD.—Ignition and electrical parts

"Flight" photograph.

Miles Masters (Rolls-Royce Kestrel XXX) on the production line at Reading.

JOHN MARSTON, LTD.—Oil coolers.
ROTAX, LTD.—Magnetos, generators, etc.
SERCK RADIATORS, LTD.—Sheet metal work.
S. SMITH & SONS, LTD.—Petroflex pipes, aneroids.
S.U. CARBURETTER CO., LTD.—Carburetters.
UNITED FLEXIBLE METALLIC TUBING CO., LTD.—Flexible tubes.
WEBLEY & SCOTT, LTD.—A.G.S. parts.
WELLWORTHY PISTON RING CO., LTD.—Gland and piston rings.
YORKSHIRE ENGINEERING SUPPLIES, LTD.—Bushes.

The Miles Master

AMAL, LTD.—Flap valves and fuel pressure regulators.
BOWDEN (ENGINEERS), LTD.—Control cables.
BRUNTONS (MUSSELBURGH), LTD.—Control cables.
BRITISH CELANESE, LTD.—Fairings and ducts.
DUNLOP RUBBER CO., LTD.—Control rings.
H. M. HOBSON (AIRCRAFT AND MOTOR) COMPONENTS, LTD., and SIR G. GODFREY & PARTNERS, LTD.—Miles compound throttle control boxes.
AUTOMOTIVE PRODUCTS CO., LTD.—Retractable undercarriages.
M.R.C., LTD.—Controls.
THE PALMER TYRE, LTD.—Brake units.
SARO LAMINATED WOOD PRODUCTS, LTD.—Plywood.
SELF-PRIMING PUMP & ENGINEERING CO., LTD.—Fuel pumps.
SMITHS' AIRCRAFT INSTRUMENTS, LTD—Instruments.
J. STONE & CO., LTD.—Castings.
SUPERFLEXIT, LTD.—Pipes, oil and petrol.
TRIPLEX SAFETY GLASS CO., LTD.—Windscreens.
SKEFKO BALL BEARING CO., LTD.—Ball bearings.
DUNLOP RUBBER CO., LTD., and THE PALMER TYRE, LTD.—Wheels and tyres.
ROTOL AIRSCREW CO., LTD.—Airscrews
J. HAWKINS & SONS, LTD.—Fuel and oil tanks, centre sections and wings.
H. H. MARTYNS & CO., LTD.—Centre sections and wings.
TITANINE, LTD.—Dopes and paints.
CELLON, LTD.—Dopes and paints.
WOODS, SON & CO.—Fabric madapolam.
JAMES BOOTH & CO. (1915), LTD., FREDERICK MOUNTFORD (BIRMINGHAM), LTD., BLACKBURNS, LTD., REYNOLDS TUBE CO., LTD., AERLEC (ALUMINIUM), LTD., and YORKSHIRE COPPER WORKS, LTD.—Duralumin sheet, tube and bar.
J. PENNY & SON, BRITISH ALUMINIUM CO., LTD., and BLACKBURNS, LTD.—Aluminium bars.
BRITISH ALUMINIUM CO., LTD.—Aluminium tubes.
REYNOLDS TUBE CO., LTD., PHŒNIX STEEL TUBE CO., LTD., TUBES, LTD., and ACCLES & POLLOCK, LTD.—Steel tubes.
J. PENNY & SON.—Steel sheets and steel bars.
G. K. & M. MOUNTFORD, MOSERS, LTD., THOS. P. HEADLAND, LTD., and BROWN BROTHERS (AIRCRAFT), LTD.—Screws, bolts, nuts and washers.
SIMMONDS AEROCESSORIES, LTD.—Simmonds nuts.
AIRCRAFT MATERIALS, LTD.—Cup and pop rivets.
PERSPEX, LTD.—Transparent sheeting.
SILENTBLOC, LTD.—Bearings.
AUTOMOTIVE PRODUCTS CO., LTD.—Hydraulic equipment.
KELVIN, BOTTOMLEY & BAIRD, LTD.—Kollsman altimeter.
H. M. HOBSON (AIRCRAFT & MOTOR).—Hobson-Penn mixture control.
ROTAX, LTD.—Ignition interlocking switch and electrical details.
L. BAMBERGER & SONS.—Wood.
WILLIAMSON MANUFACTURING CO., LTD.—Air cameras.
KAYSER, ELLISON & CO., LTD.—Valves.
GRAVINER MANUFACTURING CO., LTD.—Fire-fighting equipment